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for the Behavioral and Social Sciences

Research Report 1811

Training Adaptability in Digital Skills: The Learning Skills Bridge (LSB) Learning Accelerator

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July 2003

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U.S. Army Research Institute for the Behavioral and Social Sciences

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for the Department of the Army

Aptima, Inc.
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The objective for this SBIR Phase II project was to increase the degree to which soldiers are able to apply classroom/computer-mediated training on-the-job and to capitalize on their present digital skills in the acquisition of new and changing digital skills. Aptima, Inc. and the Group for Organizational Effectiveness, Inc. used basic theories of learning transfer to create a two-module training package designed to increase digital skill adaptability. This Learning Skills Bridge learning accelerator training package (LSB) was pilot tested, revised, and re-tested. The study found that training designed to increase basic computer knowledge (e.g., the LSB) does result in learning transfer to the AFATDS. Specifically, the LSB training eliminated any group differences based on prior computer experience, and thus compensated for deficient computer experience. Also, participants scored significantly higher on the measures of AFATDS networks and AFATDS visualization and Mapping after LSB training than they did before the training. Further, 88.8% of participants reported that the LSB training improved their understanding of AFATDS. From these results it was concluded that generalizable, transferable digital skills taught in the context of device- and job-specific goals (such as with the LSB) has promise in increasing adaptability in the use of those digital skills.

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FOREWORD

The Small Business Innovation Research (SBIR) project, "Training Adaptability in Digital Skills, Phase II," was conducted under contract number DASW01-01-C-005 by Aptima, Inc. and the Group for Organizational Effectiveness, Inc. (gOE) with mentorship by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Advanced Training Methods Research Unit. The goal of the project was to develop a marketable training program that would increase training transfer from one technology system or version to another.

ARI has a research program focusing on how to best train the digital skills necessary for increased battlefield digitization. The concept is to design training that will help personnel benefit from the full potential of improved technology. One way to accomplish that objective is to train adaptability as a key aspect of training for successful battlefield digitization.

The purpose of the Aptima and gOE two-phase SBIR effort was to increase the degree to which soldiers are able to apply classroom/computer-mediated training on-the-job and to capitalize on their present digital skills in the acquisition of newer and changing digital skills. In combination with other research being done at ARI, this work will provide part of a foundation for training adaptability in digital skills. This report is addressed primarily to training managers, developers, and system designers.

FRANKLIN L. MOSES
Acting Technical Director

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So many people have contributed to this work over the past several years that it is impossible to list them all. Apologies go to those who are inadvertently left out of this acknowledgment.

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Ms. Bonnie Carberry, an external consultant, did the graphics and helped with the web design. Mr. Stephen Bohler of gOE contributed to the data collection and analysis.

Employees of Engineering and Professional Services (EPS) graciously allowed us to sit in the AFATDS training, and they, and the AFATDS trainers and CECOM NET team at Fort Sill, were patient with our many questions and comments. Special thanks go to SFC James O'Connor, Mr. Roger Baker, Mr. Maxie Burke, Mr. Stephen Sells, Mr. Terry Camden, SFC Travathan, SFC Gluck, SFC Henry, SFC Stephens, SFC Bowen, CPT Jose Serrano, and Sergeant Dan Scraper for their assistance.

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TRAINING ADAPTABILITY IN DIGITAL SKILLS: THE LEARNING SKILLS BRIDGE (LSB) LEARNING ACCELERATOR

EXECUTIVE SUMMARY

Research Requirement:

Given the rapidity by which warfighting digital technology is being updated and replaced, successful warfighters will be those who possess a solid foundation for adaptive digital skills that goes beyond abilities to utilize specific tools and applications and includes deep knowledge of digital concepts that are relevant in every context of use. The requirement for this Small Business Innovation Research (SBIR), Phase II project was to pick an exemplar technology system and show how a training product could increase the degree to which soldiers are able to apply classroom/computer-mediated training on-the-job and to make use of their current digital skills in the acquisition of new and changing digital skills.

Procedure:

Aptima, Inc. and the Group for Organizational Effectiveness, Inc. capitalized on the basic theories of learning transfer to create the Learning Skills Bridge (LSB), a web-based two-module training package designed to increase the soldier's digital skill adaptability. The first module (basic computer knowledge), was created by working with computer-technology and learning/training subject matter experts (SMEs) to identify the basic computer knowledge that is essential to ensure learning transfer to novel or changing technologies. Through an iterative process of content development and revision, the researchers were able to identify specific questions and informational material that would facilitate the learning of computer knowledge essential for such transfer. The second module of the LSB training program (known as the "bridge" component) was developed through interviews and discussions with operational SMEs. With this information, content was produced that encourages learning transfer of the basic computer knowledge to the computer system of interest, the Advanced Field Artillery Tactical Data System (AFATDS), by illustrating the specific relationship between the basic computer knowledge and the target technology (i.e., AFATDS). The LSB was pilot tested, revised, and eventually used to collect performance data for soldiers participating in AFATDS training at Fort Sill, OK. In this final data collection, participants were pre-tested on their knowledge of AFATDS network topics and AFATDS visualization and mapping topics. Next they were given the LSB training package and told to go through both the Networks section and the Visualization and Mapping section. Then they were given a post-test to determine whether the training on the basic computer knowledge resulted in learning transfer to the target system. Sample results from the Fort Sill data collection are briefly reviewed below.

Findings:

The findings from this data collection effort suggest that training designed to increase basic computer knowledge resulted in learning transfer to the AFATDS, the target computer system. Specifically, the LSB training eliminated any group differences based on prior computer experience, and thus compensated for deficient computer experience. It was also found that participants scored significantly higher on the measures of AFATDS networks and AFATDS visualization and Mapping after LSB training than they did before the training. Further, 88.8% of participants reported that the LSB training improved their understanding of AFATDS. These results may support the notion that generalizable, transferable digital skills taught in the context of device- and job-specific goals (such as the LSB training program) has promise in increasing adaptability in the use of those digital skills. It must be noted that this was an initial study incorporating a quasi-experimental design. As such, further studies incorporating a control group are needed before more firm conclusions can be drawn.

Utilization of Findings:

The current version of the LSB is ready for use as a learning accelerator for AFATDS training. In the current version of LSB, trainees may complete sections in an order and timing of their choice. As such, training times may vary. None the less, allowing trainees to complete relevant sections of the LSB training before AFATDS training may assist trainees to complete the AFTDS training in less time while learning and retaining more of the content. AFATDS trainers may spend less time covering base computer knowledge and low-level AFATDS knowledge, so they can focus more on advanced AFATDS knowledge and skills. More important than the AFATDS application, however, the LSB training program was developed such that it can be easily re-configured to be appropriate for any target system that requires basic computer skills. For example, all branches of the armed forces are experiencing the same technology challenges, and the police and the FBI are both experiencing an incredible increase in technology use. With relatively little development, the LSB can be revised to be used for any of these. With more resources, the LSB can be developed to handle other basic knowledge – such as basic reading skills – that are needed for other target platforms.

TRAINING ADAPTABILITY IN DIGITAL SKILLS: THE LEARNING SKILLS BRIDGE (LSB) LEARNING ACCELERATOR

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TRAINING ADAPTABILITY IN DIGITAL SKILLS: THE LEARNING SKILLS BRIDGE (LSB) LEARNING ACCELERATOR

Training in Adaptive Digital Skills Is Critical

This two-phase Small Business Innovative Research (SBIR) project addressed a critical Army need: training soldiers to *adapt* digital skills to rapidly evolving technology. It is not sufficient for soldiers simply to learn how to operate today's digital equipment. Soldiers must be able to quickly transfer digital knowledge and skills to set-up, use, and maintain new software and new equipment.

The concept of Network-Centric Warfare is rapidly becoming a reality for today's modern military. While there are many variations in definition, some common attributes of this concept include the following: multiple information inputs, a collaborative approach at multiple operational levels for information processing and decision making, choice of multiple weapons platforms/resources, and a larger amount of real-time self-sequencing to accomplish tasks at a greater speed (Siebold & Benton, 2003). Many argue that, with this changing nature of warfare, information dominance is the key by which we will maintain our military advantage (Siebold & Benton, 2003). As such, military technology has been revolutionized in an attempt to facilitate the best use of information. In practically every operational context—from simulation-based training, to digital collaborative planning, to real-time video conferencing on the battlefield—the tools used by the modern "digital warrior" are networked and software based. Digital equipment and communication evolve rapidly. Shortened supplier design/production cycles and uniquely fast improvements in software and computer components mean that new equipment and techniques are fielded with unprecedented speed. The stability of the military environment, and the concomitant predictability of tasks and equipment, has become a thing of the past. This means that the "half-life" of equipment training is short, so that a soldier may face the need to master new equipment in the field. In addition, Army personnel may have to work under an intense optempo, under which learning conditions are not optimal. Thus, for Network-Centric Warfare to be a success, adaptability in learning to use equipment requiring digital skills under difficult conditions is essential.

In such digital environments, the successful warfighters are those who possess a solid foundation of adaptive digital-literacy that goes beyond abilities to utilize specific tools and applications, and includes deep knowledge of digital concepts that are relevant in every context of use. Whether faced with new tools, incremental improvements of familiar tools, or the same tools in new contexts (e.g., from a CONUS simulation setting, to a theater of war, or drug ops application), the warrior will be expected to apply what he or she already knows to quickly come up to speed on new tools, often with "just-in-time" rapidity. Ensuring this level of knowledge transfer will require new approaches to training, focused on providing a deep foundation of digital skills and knowledge, and a set of "tools" and strategies that the warfighters can use to apply what they already know to actively engage and learn new tools. In fact, one of the major drivers for the Objective Force, Task Force TLS ("Training," "Leadership," and "Soldier"), recognizes that the role of the soldier will change dramatically because of changes in technology, and that this will result in the need for an increase in adaptive skills.

The U.S. Army Research Institute (ARI) has a research program focusing on how to best train the digital skills necessary for battlefield digitization. The concept is to design training that

will help personnel benefit from the full potential of improved technology. One way to accomplish that objective is to train adaptability as a key aspect of training for successful battlefield digitization. The framework ARI chose to organize their plan of attacking this problem consists of five topics (see Figure 1), each emphasizing a different area in need of research (Moses 2001).

As highlighted in Figure 1, ARI believes that training adaptability is a key aspect of training for successful battlefield digitization. Moses (2001) suggests that "Soldiers will have to go beyond minimal operation of digital workstations to be effective" (p. 17) and that training must shift its perspective from training in "what to think" to training in "how to think." A key goal identified in Moses (2001) for digital skills training is to "develop training methods and strategies that promote adaptive/flexible and innovative behavior" (p. 18). Schaab and Moses (2001) address ways to assist soldiers in applying digital skills in a wide variety of military settings by having trainers "present instruction in the context of realistic situations" (p. 6) and "integrate digital systems into everyday work routines whenever possible" (p. 9). The purpose of the Aptima/gOE two phase effort was to increase the degree to which soldiers are able to 1) apply classroom/computer-mediated training on-the-job and 2) capitalize on their present digital skills in the acquisition of newer and changing digital skills.

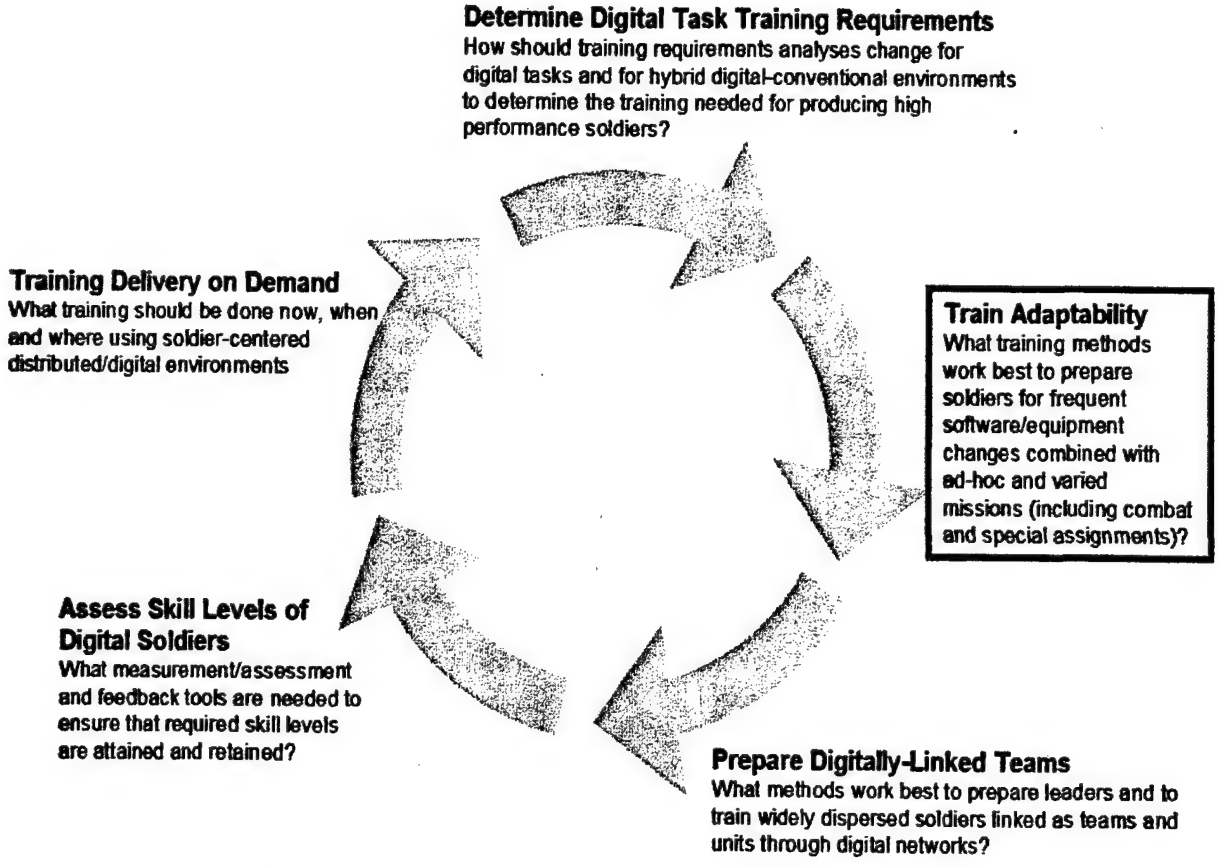

Figure 1. Five Training Challenges for Digitization (Moses, 2001) [emphasis added]

The Aptima/gOE Solution

In Phase I of this project, Aptima, Inc. and the Group for Organizational Effectiveness (gOE) laid the groundwork for an innovative digital-skills training package designed to increase the adaptability of digital skills. In Phase II the Aptima/gOE team developed the Learning Skills Bridge (LSB) "learning accelerator" training program. The LSB is a web-based training package that uses asynchronous computer-based instruction and sound pedagogical theory to train basic computer knowledge and its application to job-specific requirements. Generalizable, transferable digital skills are not taught in a vacuum but instead are learned in the context of device- and job-specific goals. This approach was developed based on the literature on learning and transfer of training. Specifically, there exist two major learning/training theories in relation to skill transfer to the job environment. The first theory, *identical elements theory*, is adopted from classical learning theory and states that transfer will occur as long as there are the same elements in the training and application environments. The second theory, *principle theory*, states that training should focus on the global principles necessary to learn a task so that the learner may apply them to a novel situation (Goldstein & Ford, 2002). While training designers typically adopt one of these two learning theories in which to base their training programs, the LSB training program capitalizes on the strength of both theories.

The LSB training package has two "modules" – one a general computer module, the other a device specific "bridge" module. Through the general computer training we adhere to "principle theory" – the instruction and assessment are designed to provide a comprehensive global understanding of important computer/technological issues. The use of the bridge module allows us to incorporate the "identical elements theory." The content of the bridge portion is designed to be specific to the technological/applications elements that the trainee will be expected to use on the job. Consequently, the LSB is designed to both increase the effectiveness of future training and increase the degree to which trained skills are applied on the job. The general device knowledge training will ensure true adaptability when going from one computer system to another, while the device-specific training will allow the trainees to take full advantage of the general training in a specific situation.

The LSB provides today's AFATDS operator with a deep foundation of computer knowledge, relates this foundational knowledge to his target computer system, and permits the delivery of training content directly to operational settings using modern distance-learning methods. This training program is also a commercial "learning accelerator" that can be adapted to prepare other users of different target systems. The LSB training provides a foundation of general digital-tool concepts and strategies for mapping these concepts to new applications. This training provides a deeper base of knowledge and cognitive learning strategies to insure rapid transfer. The remainder of this report describes how the LSB tool was developed and tested.

Developing the LSB Tool

Backend

The major requirement of the Learning Skills Bridge (LSB) program that guided development was to present information in a non-linear fashion so that the user's movement through the program is determined by his/her interests and expertise instead of a predetermined path. To allow for this, we created a software product made up of many components: a backend data server, a web server for serving dynamically created web pages, dynamic script execution for generating web pages, and the student side user interface. The software is organized into four

areas: data, student, administration, and content authoring as shown in Figure 2. Each of these areas is explained in more detail below.

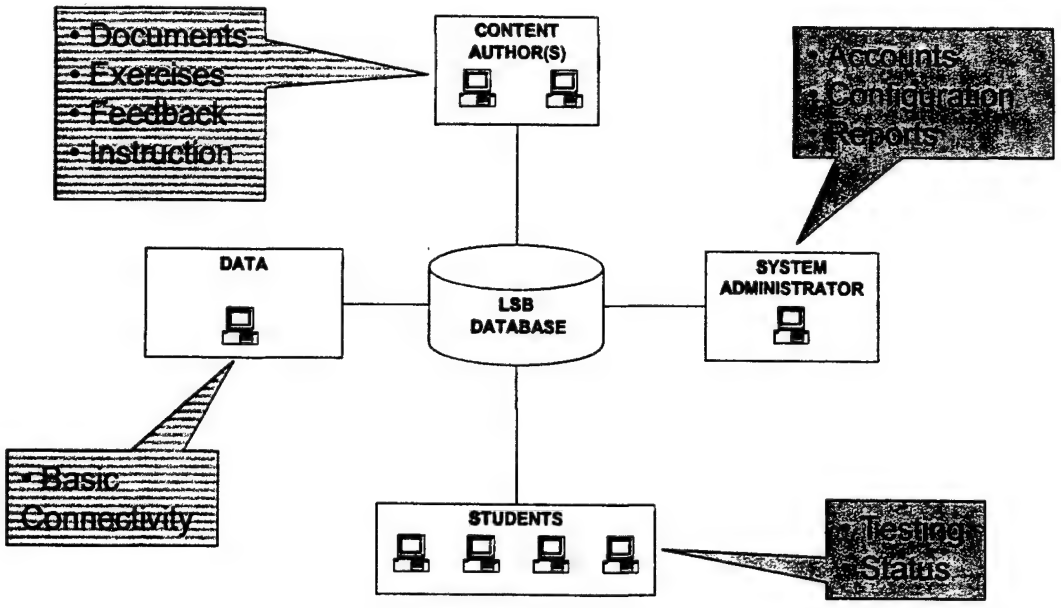

Figure 2. LSB System Architecture

Data. The "data" portion of the program provides the basic connectivity to the content and student data that resides in the database. An Application Programming Interface (API) was used to develop the PHP Hypertext Preprocessor (PHP; http://www.php.net) scripting language that makes communicating with MySQL (http://www.mysql.com) based databases very easy. MySQL based databases are relational database systems that store data in the form of related tables. This type of relational database system was needed to ensure the flexibility needed for the LSB. The database schema was designed using upfront requirements analysis and then fine-tuned via an iterative process during development.

Student. The "student" portion of the program is a large set of dynamically generated web pages that are controlled by the program. These are the pages with which the student interacts. The responses of the student govern the generation of the next page.

Administration. The "administration" portion of the program presents the local administrator with options for adding students and generating reports. The administrator also adds program specific "bridge" content, controls the number of questions a student must answer for each concept, as well as which concepts, topics, and categories to include in the customized training program.

Authoring. The "content authoring" portion of the program, one part of the "global administration" level, allows for the addition of content, both instructional and questions.

Software Used

The Aptima software developers designed the LSB system to use a Structured Query Language (SQL) database as the backend storage system. For its simplicity and speed, the MySQL Open Source product is used. The user-side interface is created using the web scripting

language PHP for the majority of the work and some Javascript programs are mixed in for various visual/programmatic effects.

The software development team used standard development workstations running Linux and Windows 2000/XP supplied with the appropriate software. Each developer created a miniature version of the actual website for testing purposes. Each workstation ran with the same versions of the servers as the actual target server.

The source control product (CVS; http://www.cvs.org) was used to store and manage the projects source code. The use of this tool creates an environment more conducive to team development. During the development process Aptima tracked the software issues using email and a simple database. Product reviews were held regularly during the phase leading up to deployment with the team reporting issues and verifying fixes.

The software is deployed on a server running Linux, Apache, and MySQL.

Content

In developing the LSB tool, our team defined a set of content areas. The information to be covered in the tool included a variety of high-level computer skill *categories* (e.g., computer networks) with lower-level *topics* (e.g., network configuration) and, at the lowest level, *concepts* (e.g., bus configuration). After initially identifying categories and their topics and concepts considered essential for basic computer understanding, computer experts' opinions on these topics were gathered.

The basic computer skills categories realized after this survey are as follows:

- Computer Networks
- Electronic Communications
- Components
- Operating Systems
- Visualization/Mapping
- Application Software
- User Interface

Each of these content areas was then populated along a generic structure as follows. For each *category* there was an overall introduction. Then, for each *topic* within that category, there was a more focused introduction for that specific topic. Finally, for each *concept* within each topic there were instructions and corresponding questions. The categories, topics and concepts were initially ordered according to priorities identified by the computer experts. This suggested order can be easily altered as needed.

The category, "Visualization/Mapping," may not be as easily perceived as part of the traditional "computer skills" domain as the other categories contained in the program. The rationale for the inclusion of this content area, however, was that one of the most unique and important strengths of computer technology is the display of electronic maps and graphics. Thus, while "mapping and visualization" could be seen as two of a myriad of possible computer applications, at the same time they leverage computer technology so effectively that they can almost be considered an extension of the user interface. In particular, military applications use maps and visualization so frequently that we considered these to be part of the "digital skills"

domain. For example, to "zoom" in or out on a map is a critical ability for many digital applications.

Introductions and Instructions

Once the categories were selected, the team authored the introductory and instructional materials for each topic through an iterative authoring and reviewing process. A lead author was assigned for each category. This individual used online and hard copy resources to write an initial draft of the introductory and instructional materials for the category, specifically creating content for each of the topics and concepts. During this process of research and authoring, the author would often identify gaps in the current list of topics and concepts for a category. The author would create additional topics or concepts to fill these gaps as the situation required.

Additionally, the author would segment the content into basic and advanced concepts. Originally it was intended that every concept would have both basic and advanced material; however, during the authoring process it became clear that some concepts were inherently basic, while others were inherently advanced, and a smaller subset could be broken into both basic and advanced. As such, the team decided to alter the software requirements to allow concepts to have only basic, only advanced, or both basic and advanced material. The distinction between basic and advanced content was relatively transparent to the user; however, the sections were organized to encourage the user to work through the basic material first before reaching more advanced concepts. Once a complete draft of a category was complete, the draft was passed through a two-tier review process. In the first tier of the review process, the content was reviewed for its technical accuracy. In the second tier of the review process, the content was reviewed for clarity and structure, with an eye towards making the content clear for individuals who are likely to have minimal experience with the topic. The second tier reviewer also focused on providing definitions to the reader for potentially unfamiliar terms. These definitions were created from combining sources from the web; http://whatis.techtarget.com/, http://www.webopedia.com/, and The American Heritage College Dictionary: Third Edition. The definitions were created to apply across the computer skills categories. Upon completion of the second tier of review, the content was converted into an HTML format and loaded into the database to be made available through the tool.

Throughout the authoring and review process, the team worked to maintain consistency in the content, providing training that was structured in a logical manner and supplemented with information that would make it easy to understand for novice users. Whenever possible, the authors and reviewers identified topics that could be accompanied by pictures and diagrams to facilitate a student's understanding of the concept. The author would create a diagram that would then be passed on to our visual designer to give it a professional look and feel.

Consistency was further maintained through examination of overlapping areas between different categories. The author for a given section served as a reviewer for the other sections. As such, each author was able to identify areas where another author was describing similar material and could come to an agreement as to how that material could be presented in a consistent fashion. In some instances, the solution was to move a topic from one category into a different category where it would make better sense. In other instances, the same material was duplicated and presented in multiple categories. And in additional instances, similar material was presented from different perspective appropriate for the category in which it was presented (e.g., email systems were described at different levels of granularity for the Electronic

Communications category and the Applications category). Overall, as indicated by subject matter experts (SMEs) from the computer engineering/programming, professional/academic training, and military operations/training fields, the authoring and review process allowed the team to create consistent, accurate content at an appropriate level of detail to train novice users in the basic computer skills categories.

Questions

The questions used to assess the trainee's knowledge level were developed directly from the reviewed and approved concept instructions. If the student answers a question wrong and is consequently sent back to the instructions, he will be able to find the answer to the question within these instructions. Questions are either True/False or multiple choice with a minimum of three choices. After each question is answered, immediate feedback lets the trainee know if his answer is right or wrong. When the answer is correct, the trainee receives a confirmation that he answered the question correctly along with the correct statement, occasionally with further information regarding the question content. In this way the correct information is reinforced. When the answer is wrong, the trainee receives feedback that the answer was incorrect and why. To determine the correct answer, however, he must read the concept instructions. An example of a question with feedback can be seen in Table 1.

Table 1. A Question, Answer Choices, and Feedback Found in the Database.

Question	Choices	Feedback
A thread is made up of:	instructions.	Correct! A thread is a part of a program, or list of instructions, that can execute independently of other parts of the program.
	processes.	Incorrect, a thread is **not** made up of processes.
	programs.	Incorrect, a thread is **not** made up of programs.

In creating questions, the team avoided creating questions in which the correct answer is the concept title. For example, in a concept called Threads, the trainee would never be presented a question like the following: "A _____ is made up of instructions", where Thread is the correct answer. Choices such as "all of the above" and "none of the above" were also avoided because the tool will present answer choices to the trainee in a random order. Moreover, "all of the above" and "none of the above" tend to make the question scoring more difficult to justify, because test-takers can often legitimately argue for such an answer despite the test-writer's intentions. In computer-based testing, it is particularly important to avoid any potential ambiguity in items, since there may be no available human resource for the user to turn to with concerns.

Bridge

The next fundamental area for content development was the "bridge" portion of the program. By design, this content is totally dependent on the system for which the LSB program is being used (e.g., AFATDS). To develop this material, subject matter experts (SMEs) defined the types of material trainees should be presented for each of the relevant topic areas.

Specifically, for the AFATDS program, we asked AFATDS instructors at FT Sill to indicate which topics within each category should be presented to the trainee (e.g., when considering the configuration of the AFATDS system, is it more like a star, bus, or ring computer network and how). The instructors were also asked specifically how the basic computer concepts available apply to AFATDS. If a topic was not relevant in regards to the AFATDS program, it was not presented to the trainee. AFATDS instructors had no difficulty deciding which content was relevant to AFATDS. Moreover, the instructors took some time to explain the AFATDS system in detail to enable the inclusion of AFATDS specific diagrams based on instructor input.

We also used this opportunity to have the instructors tell us how they actually use AFATDS. This information was crucial for the "category bridge" that summarized how each category, in its entirety (e.g., computer networks), is operationalized with the AFATDS system. This category bridge content is presented after the trainee has successfully completed a category. The bridge content is presented to help the trainee have a better understanding of the "big picture" and how these skills tested are applied within their operations.

The last sections of the program requiring content were the main introduction to the LSB program and a general description of the specific system described in the bridge material. The main introduction informs the trainee why they are using this program and gives them some background on the system for which they are being trained. The instructions explain to the trainee how to navigate within the LSB program and the fundamental pages that will be presented: Assessment Pages, Instruction Pages, Bridge Pages and My Progress Page.

The Bridge "Philosophy." The Bridge is central to the LSB program, and makes the program different from a standard program that teaches computer skills. The bridge uses digital concepts that have just been learned and/or reviewed by the user and maps those concepts onto the topic of interest, in this case AFATDS. Thus, immediately after learning and/or reviewing the general digital topic "Types of computer networks," the user learns how AFATDS is a network. After learning and/or reviewing information on "Types of user interfaces," the user learns about the user interfaces in AFATDS. Of course, the Bridge content can be modified to address any digital platform or technology. This makes the LSB program highly adaptable to the needs of the US Army.

We believe that the combination of questions, instructions and remediation (on the general digital skills content), combined with the Bridge (general content applied to specific digital platform) represents the best practices in pedagogic design. For example, one of the facts haunting instruction theory and practice is that generalizability of even well-learned principles and facts is limited (Alliger, Tannenbaum, & Bennett, 1995). By immediately instantiating learned general digital skill knowledge into the context of a particular tool or platform, however, the learner is able to "make the connection" between concrete and particular. In effect, the generalization process is being assisted. "Network configuration" is no longer just a concept, but is particularized as a specific kind of network for a particular tool or platform.

Beyond this, the Bridge has the additional advantage of making the general into the particular in an entirely different way – through personalization of the content. General knowledge is just that, general, and not especially related to any given individual. The users of the LSB program, however, will be shown Bridge material that relates specifically to a platform on which they will be shortly trained, and which, in fact, may be central to their US Army career identity (e.g., their Military Occupational Specialty; MOS). For this reason they can be expected

to see the material as relevant to themselves as individuals. Although it is at this point only an inference, the following argument seems reasonable: making general information personalized by tying it to a platform on which soldiers are to be trained may increase motivation to learn in that training. The fact that the platform is not a "black box" but has been contextualized through the LSB (e.g., AFATDS is not just a computerized system of unknown character, but a networked system already pre-framed and understood as possessing many characteristics of other networked systems) may lead to a greater sense of willingness to tackle the formal training program. This is an hypothesis only, of course, but one that could be tested without difficulty, provided the right participants and situation.

Usability Evaluation

One of Aptima's in-house usability experts, Dr. Gabriel Spitz, performed a full usability evaluation of the LSB site, both the user side and the local administrator side. Summaries of Dr. Spitz' findings and the actions taken in response are detailed below.

User Side

The objective of this effort was to perform a heuristic evaluation of the Learning Skills Bridge web site and application. This evaluation consisted of a systematic walk through the site and assessment of the usability aspects of each page type, the interaction within a page, and the navigation between pages. The primary usability aspects that were reviewed and evaluated during this effort included navigation, functionality, user control, feedback, and consistency.

Overall the site design was nice and appealing. Although this was not part of the usability evaluation, the content of the site was well thought out, the language used was clear and straight forward, and the questions and the options provided were very well constructed. The graphics and color schema of the site were also very well thought out and presented in an effective and aesthetically pleasing way. The area where the site or module needed to be improved was in its usability. At a high level of abstraction some of the usability issues identified include:

- Unclear conceptual model of the module due to absence of a site and module home pages
- Several instances of inconsistency with user interface design conventions such as using the hand pointer when displaying "What's This" information
- Missing functionality such as a mechanism to deal with forgotten passwords.

From these recommendations, improvements were made to the login page (e.g., "forgot your password?" link) and the introduction page (more information about the target system – AFATDS – and how the LSB program will help the user better learn the target system were included). "Help" pages and a "log-out" page were added. The look and feel of the "my progress" page was changed to allow the student to more quickly see what they have left to do to complete the training program.

Local Administration

Dr. Spitz also performed a similar evaluation for the local administrator pages. Again, his expert advice was taken and changes in the interface were implemented. These changes include making the login page more visually appealing and adding a "forgot your password?"

link; better navigation by allowing the local administrator to access all three major sections from any page within the site; adding a log-out capability; improving the student reports by allowing the local administrator to sort and select which to view; and improving the content management capabilities of the program.

Validation Research

Initial Data Collected with National Guard

The LSB was launched with the National Guard Soldiers of the 147th FA Brigade, 1st BTN. Data were collected at Camp Ripley to determine the program's usefulness and face validity. The results are summarized below.

Participants and Methods

Nine National Guard Soldiers (all men) participated in the LSB training program before participating in the AFATDS training. They were given instructions for the LSB program, along with IDs and passwords, two weeks before their scheduled AFATDS training. After their AFATDS training, they were asked to give feedback on the utility of the LSB training program in preparing them for the AFATDS training.

Summary of Findings

Overall, the Learning Skills Bridge was well received by almost all of the individuals who logged on and used the system. The Networking material was most commonly mentioned as a topic that provided a solid foundation in terminology and understanding prior to AFATDS training. Most interviewees also felt that LSB could be useful as a refresher course after the completion of AFATDS training in addition to its current pre-training implementation. More specific to the method of implementation in this program, most participants had very positive comments about the "answer questions to determine where I need to read" method of presentation rather than being required to go through the entire volume of text. The pictures and diagrams were also well received and discussed as being beneficial for understanding concepts. Overall, participants felt that LSB was a good refresher in computer-related concepts, and most thought they learned something they didn't know before by going through the program.

The most common negative comments related to the initial learning of the navigation scheme, length of the program, and a desire for more AFATDS-specific material. Several participants discussed difficulties learning the navigation scheme initially. Comments indicated that there was no clear place to start. Several individuals felt there was too much need for navigation; they would prefer a system that required fewer decisions and simply allowed them to walk down a pre-set path to completion of the program. Regarding the length of the program, most participants felt that the progress pages were useful; however, several indicated that they did not have a clear idea of how much more training was still required. Opinions were split as to whether the training was too long or just right, with a slight lean towards the training being too long. The amount of time required for completion varied greatly between participants but did not seem to affect their opinions as to whether the program was too long or not (i.e., some of the individuals that spent the most time in the program felt the training was just right). Finally, interviewees regularly commented that they expected to see more AFATDS-specific information and thought that tying the LSB even more closely to the AFATDS training would be beneficial.

Conclusion

In summary, the comments and suggestions made by the National Guard Soldiers were invaluable for the further development of the LSB program. For a more rigorous testing of the program's validity, more data were collected at FT Sill, OK, on September 23-26, 2002.

Fort Sill Data Collection

Participants

The 62 male soldiers had a mean age of 19.74; 64.5 percent were under the age of 20; the youngest age was 18, the oldest 30. Most of the soldiers in the sample were privates: 43.5% had a rank of E-1, 40.3% a rank of E-2, 14.5% had a rank of E-3; there was a single E-4 (Specialist) in the sample. The MOS of all soldiers in the sample was 13D, Field Artillery Tactical Data Systems Specialist.

Research Design

The soldiers were given pre-tests in two LSB AFATDS modules, Computer Networks and Visualization/Mapping. The soldiers next completed these two modules in LSB and then completed post-tests. A schematic of the evaluation design is shown in Figure 3. While the researchers believe that the results of this study are sufficiently strong to mitigate the threat to validity associated with quasi-experimental designs, the accuracy of conclusions regarding the impact of training on pre- and post-test differences may be questioned without the use of a control group.

Figure 3. Research Design for Evaluation at Fort Sill

Materials and Procedure

The testing was conducted with small groups of up to 16 people. Each room had 16 computers, all with Internet accessibility. The participants were provided a quick rationale for their participation, and then asked to complete a pre-test. After the pre-test was collected, they were instructed to logon to the LSB and complete two modules: Visualization/Mapping and Computer Networks. These two were chosen for the following reasons: AFATDS is a highly networked system, and maps are a crucial AFATDS application. After all individuals had completed the LSB modules, they were asked to complete the post-tests. They could not look back at any LSB screens during the post-test.

The Computer Networks test was a 20-item test, the Visualization/Mapping test had 10 items. The tests were True/False/Don't Know format. Because these tests contain sensitive information concerning the AFATDS training program, they are not included in this report.

Sample Description

Participants reported varying levels of computer experience, as seen in Figure 4. The anchors for this question had the following descriptors: Slight = e.g., have spent some time with

computer games or surfing the web; Basic = e.g., some word processing, email, surfing the web; Intermediate = e.g., word processing, email, spreadsheet, surfing the web; Advanced = e.g., able to troubleshoot computer problems, programming. One reason to collect this information was to be able to examine an hypothesis of interest: the greater the prior computer experience, the better participants would do on the pre-tests, while still showing an improvement on the post-tests.

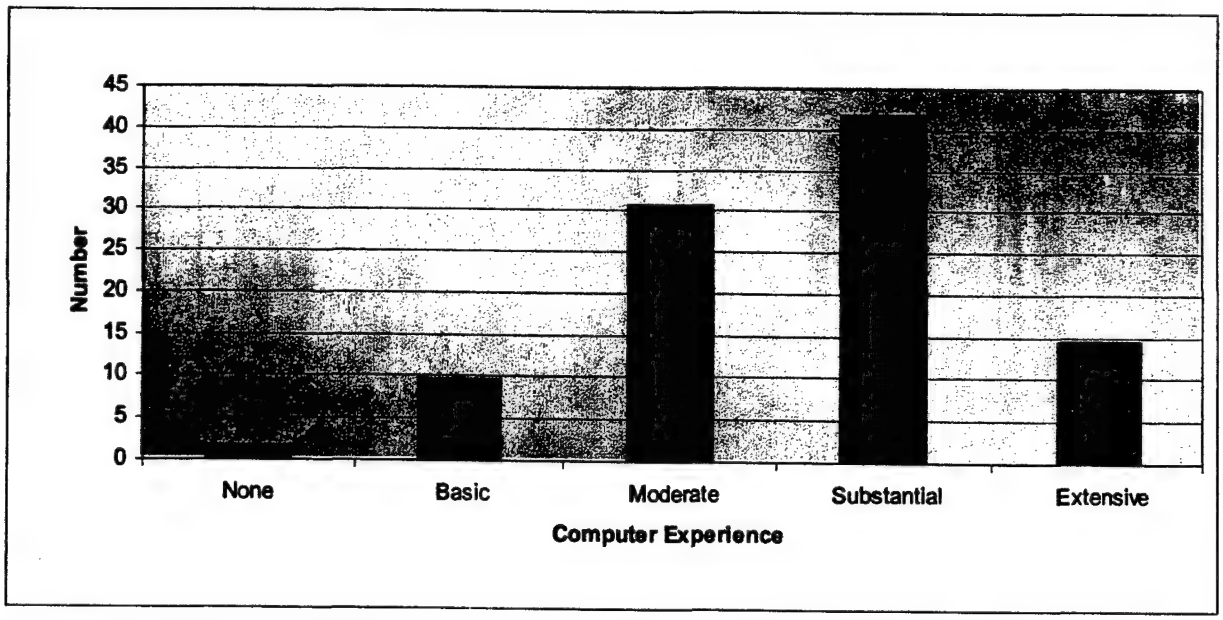

Figure 4. Number of Participants Indicating Varying Levels of Computer Experience

Participants were also asked whether they were familiar with AFATDS. 46.8% said "No," while 51.6% said "Yes." One participant did not answer this question. Of those who said they were familiar with AFATDS, most reported some degree of training experience, from 1 to several weeks. This question, like the question on computer experience, was asked because it was thought that test performance might differ based on the answer participants provided.

Test Score Results

Participants did better on both the networks and the visualization/mapping tests after LSB training than they did before. The descriptive statistics for the tests are shown in Table 2. Note the change in means, pre to post, and also the increase in the "floor" or minimum scores. The internal consistency of the tests, as indexed by Coefficient Alpha, was acceptable (the lower alpha for the post-test Visualization/Mapping test is probably simply indicative of a multi-factor test).

Table 2. Descriptive Statistics for Pre- and Post-Test Scores

		N	Minimum	Maximum	Mean	Std. Deviation	Alpha
Pre-Test	Networks	62	0	80	37.9	22.9	.846
	Vis./Mapping	62	0	100	53.1	29.9	.828
Post-Test	Networks	62	35	100	81.6	15.6	.758
	Vis./Mapping	62	50	100	89.8	12.2	.468

The distribution of pre and post scores is shown in Figures 5 and 6. These distributions are typical of pre- and post-test distributions showing a normal, substantial learning effect.

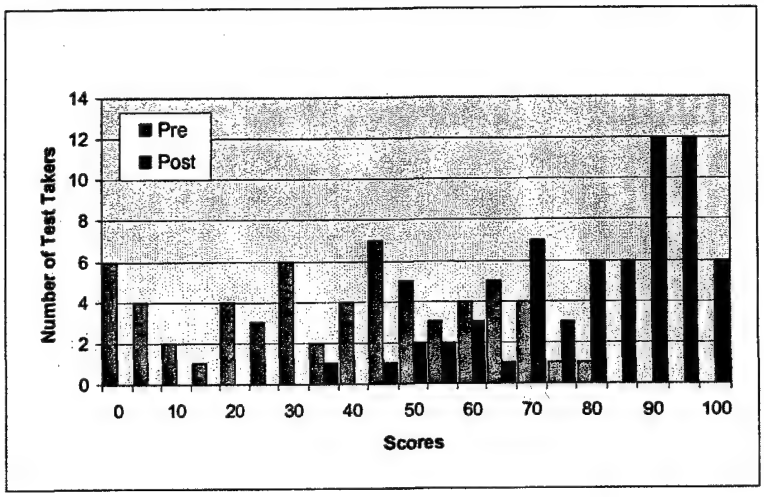

Figure 5. Distribution of Test Scores: Computer Networks

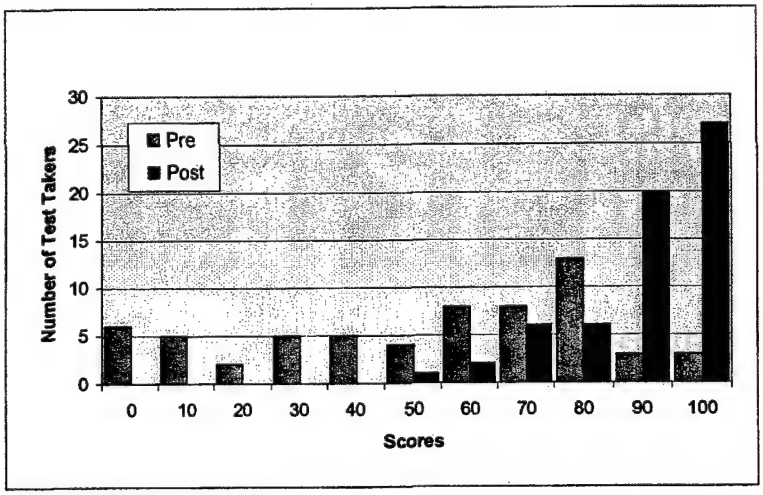

Figure 6. Distribution of Test Scores: Visualization/Mapping

One important question of interest, of course, is whether the test gains are substantial enough to allow the conclusion that a true gain occurred (this is often termed "statistical

significance"). Figure 7 shows pre and post means, with the standard error of the means plotted as error bars. Two conclusions can be made: first, that participants found the test on visualization and mapping substantially easier than the test on computer networks, and second, that the performance on the post-tests was substantially better than performance on the pre-tests. That is, a real gain occurred in knowledge (as measured by the tests) – the soldiers knew more about both AFATDS visualization/mapping and AFATDS networking in the post-test than they did in the pre-test. It is possible that the higher post-test scores resulted from the practice effect of the pre-test; however, the findings were so strong that there seems to be a main effect for the LSB training such that the training resulted in the increased knowledge.

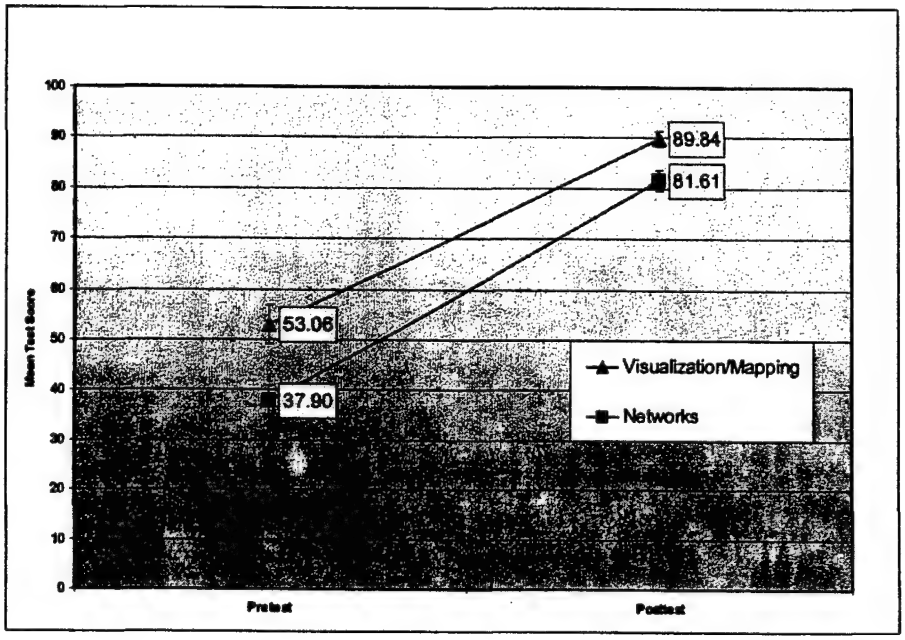

Figure 7. Mean Pre- and Post-test Scores

Comparing pre- and post-test scores for soldiers with some versus no AFATDS training. One hypothesis was that soldiers with some AFATDS experience would do better on the pre-tests and on the post-tests than those without AFATDS experience. This hypothesis held true for the pre-tests; however, LSB training seemed to eliminate any post-test differences due to prior AFATDS experience training for Visualization/Mapping (see figure 8). Note that the quasi-experimental nature of this study makes it impossible to state with certainty whether these findings were the result of learning from the training or rather the result of having experienced the pre-test (Cook & Campbell, 1979). Such a "testing effect" would result in increased post-test performance for all participants; however, it would not be expected to result in the *elimination* of differences due to prior experience that was found in this study.

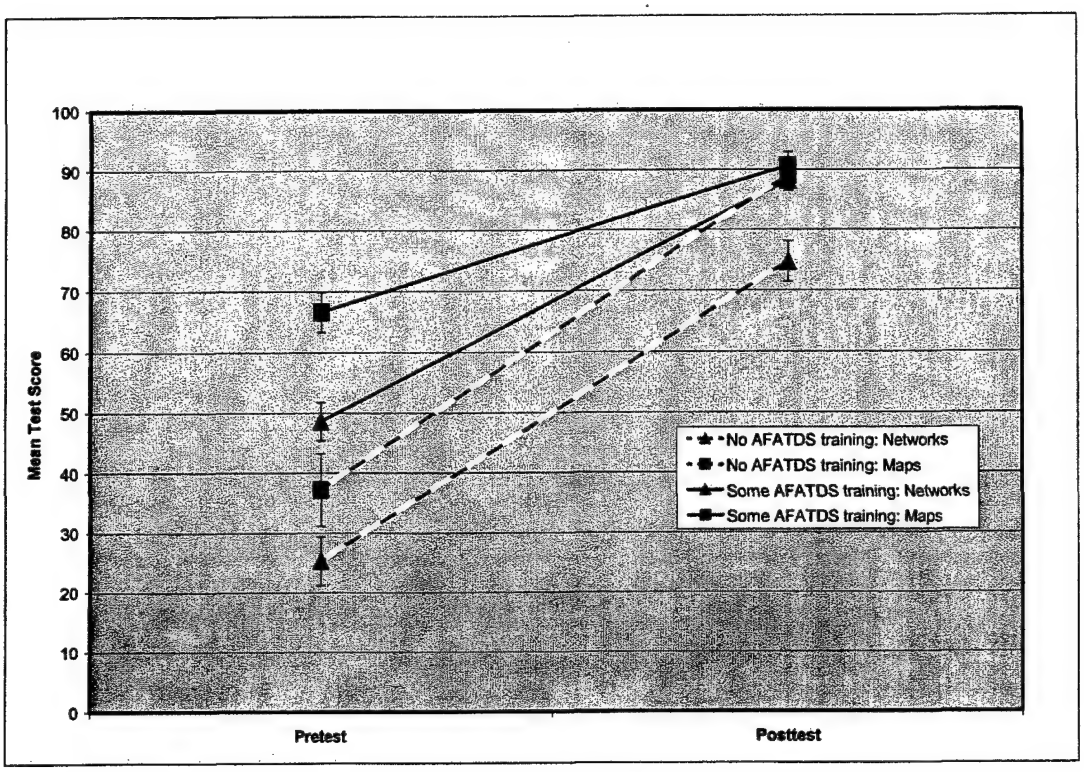

Figure 8. Mean Pre- and Post-test Scores by Prior AFATDS Training

Comparing pre- and post-test scores by level of reported computer experience. Prior computer experience correlated with Networks test performance, as shown in Table 3. This is reasonable, given that computer networks is more likely than mapping to be understood by someone with some computer experience.

Table 3. Correlations of Computer Experience with Test Performance

	PREMAP	POSTMAP	PRENET	POSTNET
r	.021	.171	**.315**	**.368**
2-tailed sig	.869	.189	.013	.004
N	61	61	61	61

When the mean scores are broken out by level of computer experience, this correlation between computer experience and networks test scores is seen clearly (see Figure 9). Moreover, the upward trend in means on the networks test across levels of computer experience is evident in the post-test as well as the pre-test.

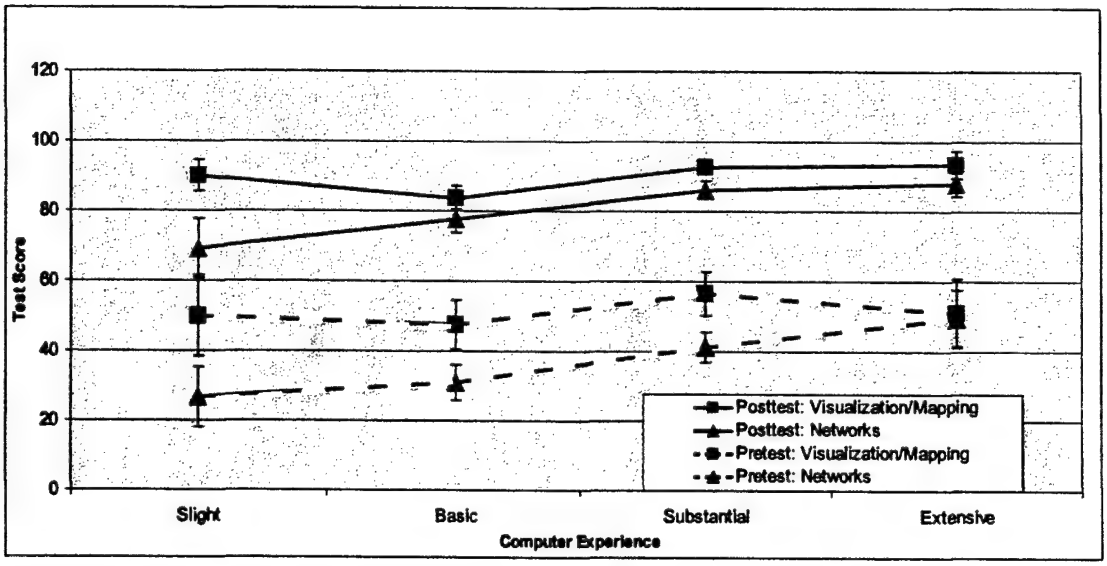

Figure 9. Mean Pre- and Post-test Network Scores by Computer Experience

Comparing pre- and post-test scores by both level of reported computer experience and prior AFATDS training. Figures 10 and 11 show the influence of both computer experience and prior training on test performance. In general, the graphs can be interpreted as showing that computer experience assisted soldiers on the Networks test only, while AFATDS experience assisted soldiers in both Networks and Visualization/Mapping. This makes sense, since mapping is a topic that should not be assisted by prior computer knowledge, while prior AFATDS experience should assist participants in both the mapping and networks areas.

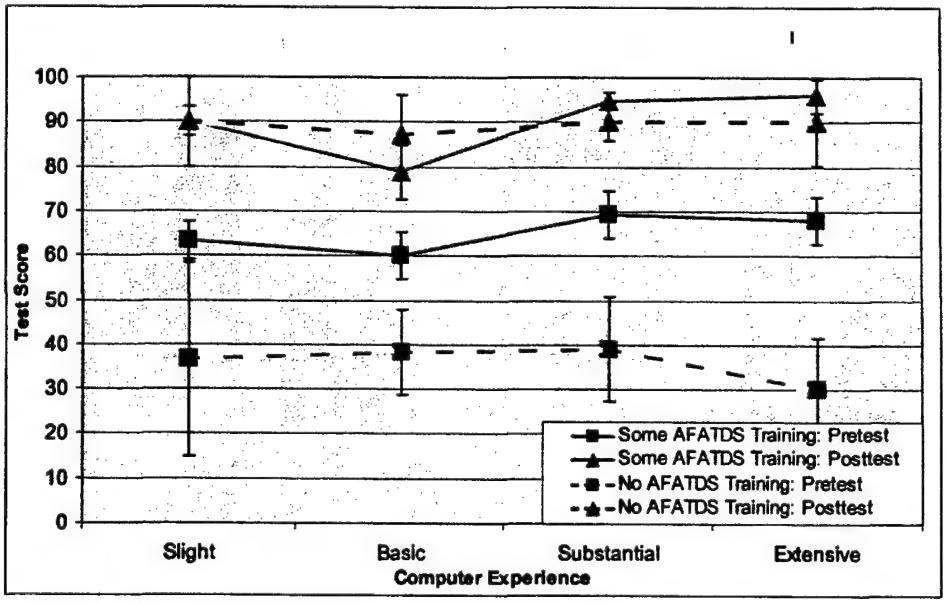

Figure 10. Mean Pre- and Post-test Visualization Mapping Scores by Prior AFATDS Training and Computer Experience

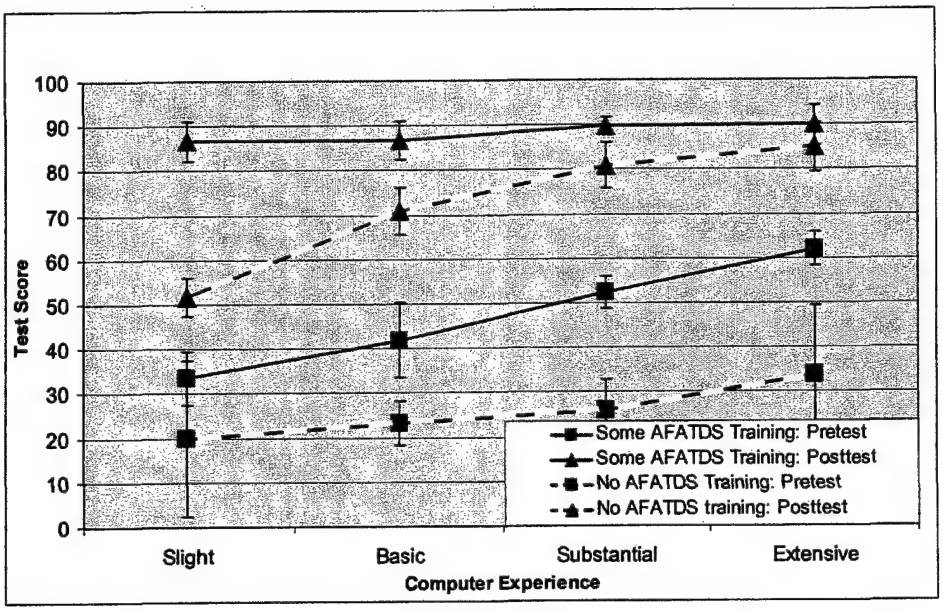

Figure 11. Mean and Pre- and Post-test Computer Network Scores by Prior AFATDS Training and Computer Experience

Participant Reactions. Our observations during the training sessions indicated that participants were able easily to complete the LSB modules. Moreover, a reactions questionnaire was administered. The responses to some of these questions were content coded; the results of this content-coding are shown in Table 4. These responses, as a whole, show a very favorable response to different aspects of the LSB experience.

Table 4. Responses to the Reactions Questionnaire

Question	Content-coded results
1. Did you find the introduction to be effective at explaining the purpose of the system and how to use it?	Yes – 90.3% No – 3.2% Somewhat – 4.8% No response – 1.6%
2. Was the system easy to navigate through?	Yes – 98.4% No response – 1.6%
3. Were the assessment questions too easy? Too difficult? Just right?	Too easy – 11.1% Too difficult – 6.3% Just right – 71.4% Other response – 9.5%
4. Were the lessons written in a way that made the concepts easy to understand?	Yes – 72.5% No – 4.8% Somewhat or Other – 22.7%
5. Do you feel that the system improved your understanding of AFATDS?	Yes, considerably –8.1% Yes, slightly --19.4% Yes -- 61.3% No--9.7%

The participants also indicated what they liked and did not like about the system. Most responded that the system was informative and easy to understand. Many said that it was

instrumental in teaching them about hardware and software and the AFATDS program. A majority of the respondents could not think of anything about the LSB that needed improvement, or their suggestions were superficial (e.g., "color scheme"); however, eight soldiers thought the program was too long or had too many questions.

Research Conclusions and Implications.

In summary, the LSB program was very well received by the Soldiers. They responded positively to it, generally finding it easy to use and believing it to be helpful in preparing them for AFATDS training. Testing results showed significantly improved scores on the AFATDS material and knowledge of basic computer systems.

The effects of prior computer experience and prior AFATDS training affected LSB performance as expected: relevant test scores were improved; however, it is useful to point out that neither of these variables eliminated the much more powerful main pre-post effects for both of the examined AFATDS modules. The primary lesson here is that the LSB seems to be a potent method of learning that can be of benefit even to users with some prior computer experience and/or some exposure to AFATDS.

It should be remembered that this research examined performance on only two of the LSB AFATDS modules. One reasonable question is whether the increases in performance that were shown for both of the modules in this research (Computer Networks, Visualization/Mapping) also will occur on the larger scale of all the modules that apply to AFATDS. This question can only be definitively answered empirically. However, likely gains from pre- to post-test would be similar in all AFATDS modules if we make two assumptions: 1) assume a matrix of generally positive intercorrelations, as found previously among tests of achievement (Alliger, 1988); and 2) further assume that the learning that can be gained from the other LSB modules is of similar magnitude since each content area was written according to the same standards and subject to the same review.

If there was a perceived negative to the LSB system, it is that to some soldiers the experience seemed "too long" or "too drawn out." This probably is due in part to the fact that the LSB is academic, requiring users to study material and answer questions, understand remediation – in short, to be a student. Being a student requires attentiveness, which can be tiring over a period of time. Given that this perception was reported by a small minority of soldiers, it is not in itself excessively worrisome. On the other hand, in this research soldiers were exposed to only two modules. In a complete rollout of the system, the perceptions of tedium could increase since there would be substantially more material to cover. This suggests that the "Start/Stop/Restart" feature of the program is important. That is, because users can begin an LSB session, stop when necessary, and resume when convenient without losing any progress through the program, issues of boredom and fatigue are minimized. Add to this the fact that learning seems best when it is distributed in sessions over time (Baddeley & Longman, 1966) Probably the recommended way for users to experience the LSB is in a time-distributed manner.

Overall, then, the Ft. Sill research effort indicates that the LSB can provide substantial learning to candidates for AFATDS training. Further research could extend the current findings in a number of ways, however, and is recommended. Of particular interest are the effects of full LSB training on actual performance in AFATDS and on field performance. Also, experimental

studies incorporating a control group should be performed to fully determine the effectiveness of the LSB training, and it would also be useful to assess group differences based on ethnicity.

Final Product

Based on the feedback from the usability studies and data collection, improvements were made to the LSB program. The final product for this project is a dynamic web-based training program (Learning Skills Bridge). It is designed to both enhance current and future technology-based training and to enhance transfer of learned skills to the field setting. For those who do not have the opportunity to experience this program first hand, we have provided a walk through of the program in the Appendix.

We believe that a clear need is met by the Learning Skills Bridge, that it possesses a compelling and pedagogically superior design, and that results to date indicate its potential. The LSB is designed to allow local administrators extensive control over how the program uses its core information to tie into a target field application, tool, or platform. Users, too, have substantial freedom in navigation and in scheduling their participation. In short, we believe that the LSB has a successful and highly adaptable design, and will meet the need for military and non-military users and administrators alike in training adaptability in digital skills.

Overall Conclusions and Implications

This SBIR Phase II has not only provided a great deal of evidence indicating the need for digital skills – as revealed by participant's reactions and comments during our final data collection – but it has provided evidence for the usefulness of training general computer knowledge to achieve adaptability in digital skills. The great majority of participants reported benefiting greatly from this training and felt the training better prepared them for using the target system (i.e., AFATDS).

While our training philosophy and methodology is more than sufficient to result in digital skill adaptability, we cannot say that it is *necessary* for such adaptability. In other words, it is clear that the combination of principle and identical elements theories, as demonstrated in the LSB training, results in adaptability of digital skills, but we can not say that this result is better than the application of either of the theories alone. To remedy this, we recommend a trial implementation of the LSB in the AFATDS environment, with a long-term plan to follow trainees through AFATDS training and out into the field. Such an implementation could continue to test the effectiveness of the LSB in one targeted training environment, and the longitudinal nature of such a study – which would last through introductions of new versions of the AFATDS computer system – would allow for further and more rigorous testing of the LSB's ability to train adaptability in digital skills.

In addition, it would seem important to adapt the LSB (and, as mentioned, ease of adaptation was "designed into" the system from earliest specifications) to a new platform besides AFATDS. One of the many other U.S. Army platforms requiring digital skills could serve as a testbed for examining the effectiveness of the LSB. Such ongoing research can provide information that would allow the LSB to be as effective as possible in promoting digital skills and optimal training performance in the US Army.

Commercialization

In addition to providing a compelling product for training adaptability in digital skills for AFATDS operators/trainees, the LSB's design affords a much broader application. With the two-

module design, re-tailoring the bridge module to a new domain should benefit a new (i.e., non-AFATDS) training area. As such, Aptima has begun a process of exploring the possibilities by which this technology can be applied to a wide variety of jobs and settings.

As a first step, research has been, and continues to be, conducted to assess the current market state for web-based asynchronous learning management systems in order to identify the market potential for the Learning Skills Bridge (LSB) product. Specific markets Aptima is actively pursuing outside of the defense sector include policing agencies, emergency management agencies, hospital settings, and secondary education settings. Aptima's reason for targeting these markets is two fold. First, these settings have been identified as supporting and benefiting from technology use and have segments of their population who are novice technology users. Secondly, these are areas in which Aptima has a high level of generalizable domain experience. We believe that the combination of these factors combined with the ease by which our system is adaptable provides a very attractive incentive to trainers in these fields.

Successful commercialization will be achieved through a variety of methods including professional conference presentations, full-scale validation studies in field settings, and direct marketing through partnering with organizations who have a niche in the fields of interest. It is important to note that these efforts directed to the private sector will serve to compliment our commercialization efforts in the government/defense arenas. Aptima will continue to aggressively market our technology to address needs both within the Army and other branches of the military, as well as other government organizations. As evidence of our commitment to the goal of commercialization, we have submitted a proposal and pricing list in an effort to be registered under the General Service Administration's Management, Organizational and Business Improvement Services (GSA MOBIS) schedule. We are confident that our efforts will result in successful commercialization both within the government and private sectors.

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Schaab, B. B., & Moses, F. L. (2001). *Six myths about digital skills training* (Technical Report 1774). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

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Appendix. Walk-Through of the LSB Learning Accelerator Training Program

This Appendix describes the product from a user standpoint. It first walks through the introduction section. The reader will then be guided through the introduction of the first category – *computer networks*, and through the introduction of the first topic within this category – *types of computer networks*. The walk-through then precedes through one concept for that topic, in this case *LAN*. In addition, the Appendix will demonstrate special features of the program including "rollover" capabilities, instruction pages, progress pages, bridge pages, and help pages. Our hopes are that this will provide the reader with an understanding of the capabilities and features of the LSB training program.

A user begins by typing in the following URL into his Internet browser, http://www.learningskillsbridge.com/AFATDS/. Once on the AFATDS main page (Figure A-1), users may access the program by typing in their user id and password.

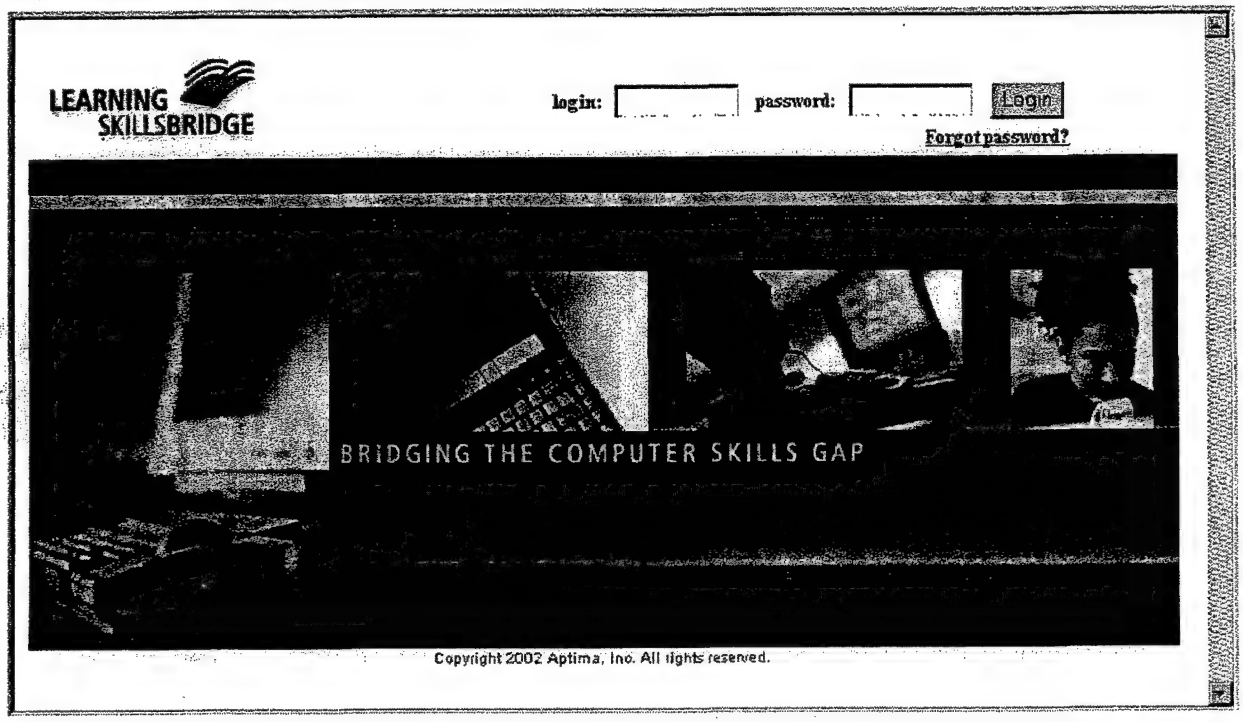

Figure A-1. Screenshot of User Login Page

For those who have forgotten their password, a link is available labeled "forgot password". Clicking on this link takes the user to a page in which they are prompted to enter their user ID, password, and confirmation of password (Figure A-2). Clicking the "submit" button sends an email to the global administrator prompting the global administrator to verify the validity of the email address and user. Upon verification, the global administrator will then email a new password to the user within 24 hours.

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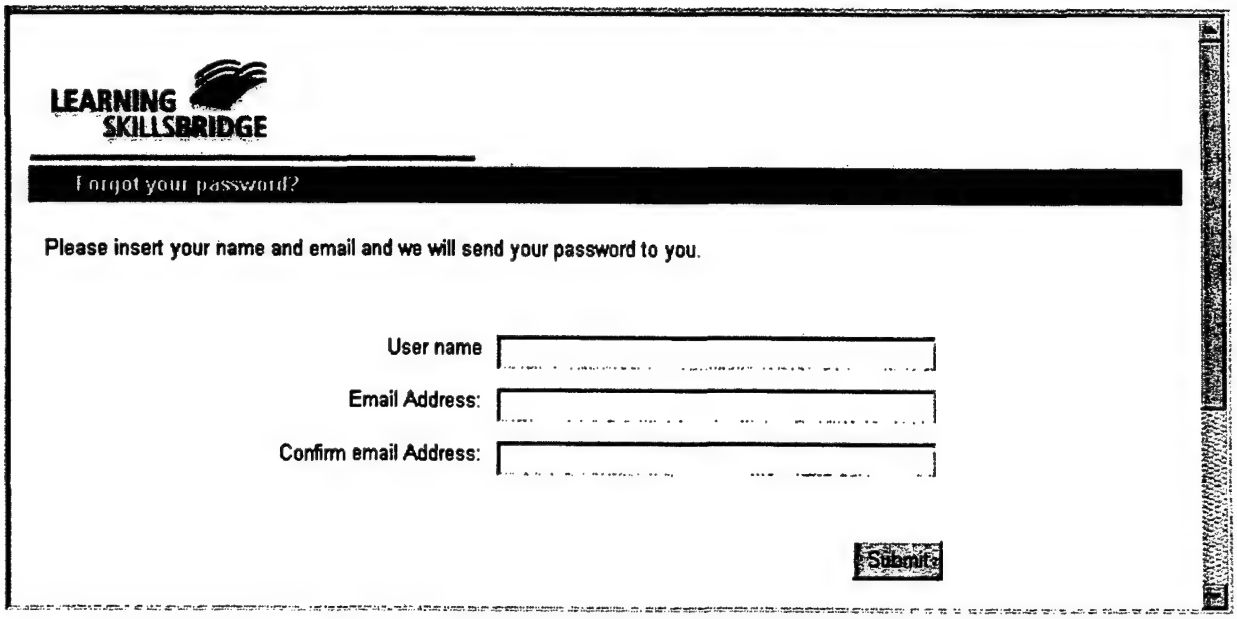

Figure A-2. Screenshot of "Forgot Your Password" Page

If the user types an incorrect user id and/or password, the user receives the message "illegal login, please try again" beneath the login text box (see Figure A-3). Once a user has successfully logged in, they are taken to the introduction page (Figure A-4).

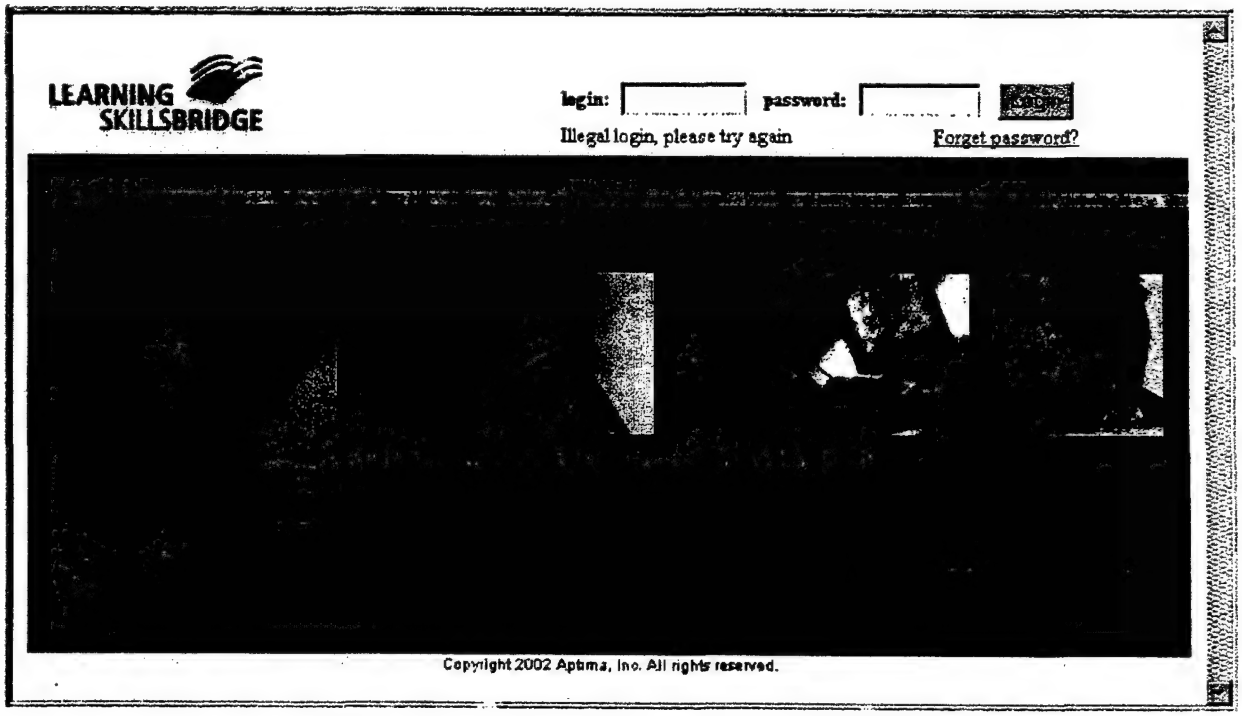

Figure A-3. Screenshot of "Illegal Login" Page

The introduction page is highlighted by a variety of categories running horizontally across the top margin of the page and topics running vertically down the left hand margin of the page. The topic choices (left margin) will change depending on which category (top margin) is highlighted.

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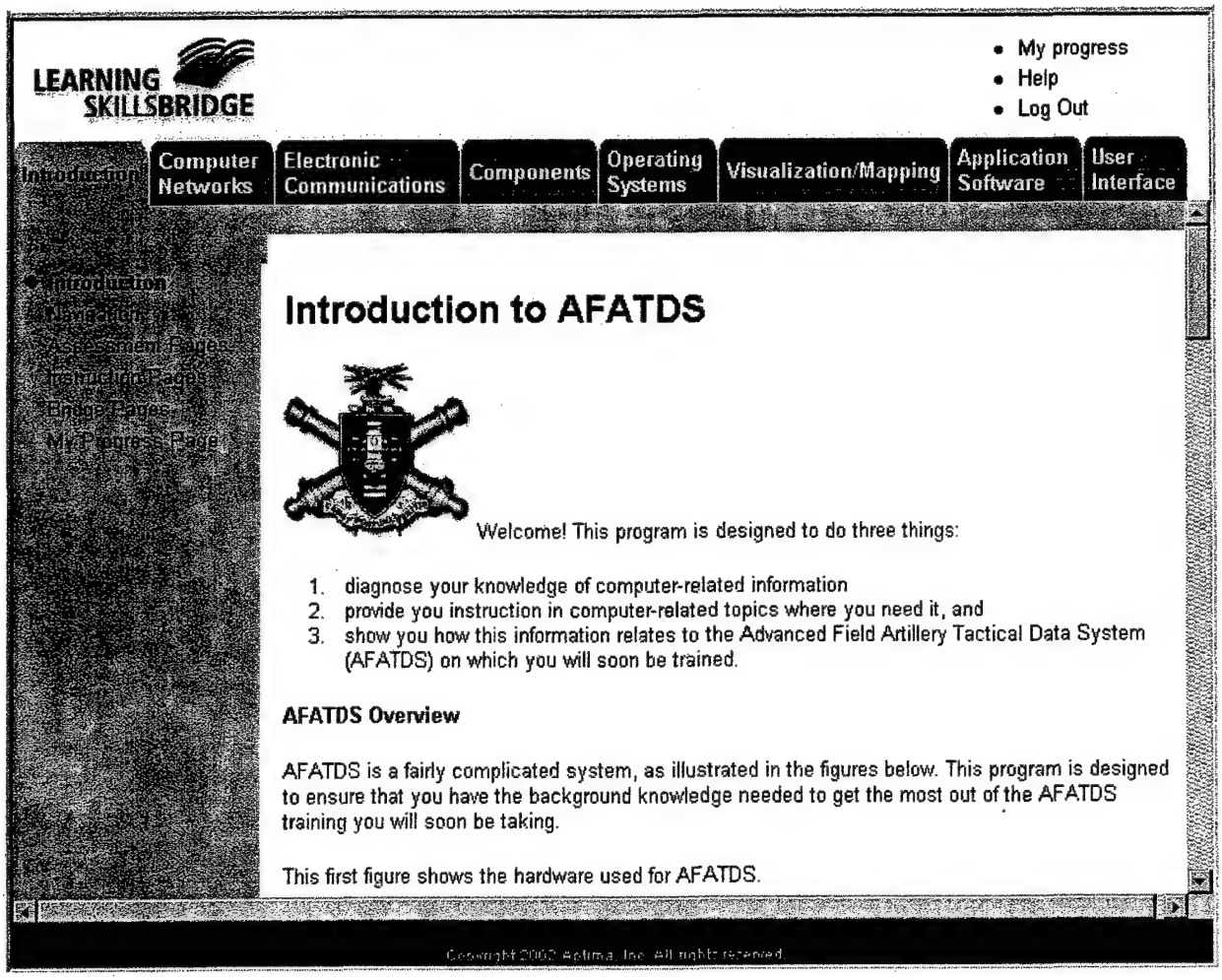

Figure A-4. Screenshot of "Introduction to AFATDS" Page

Walking through the introduction topics down the left hand side, a user is provided with useful information regarding the purpose of the program (introduction), description of the navigation layout for the LSB program (Figure A-5), descriptions and screenshots of assessment pages (Figure A-6), an explanation of how instruction pages may assist users (Figure A-7), descriptions of the bridge components (Figure A-8), and information regarding how users may track their progress through the program (Figure A-9).

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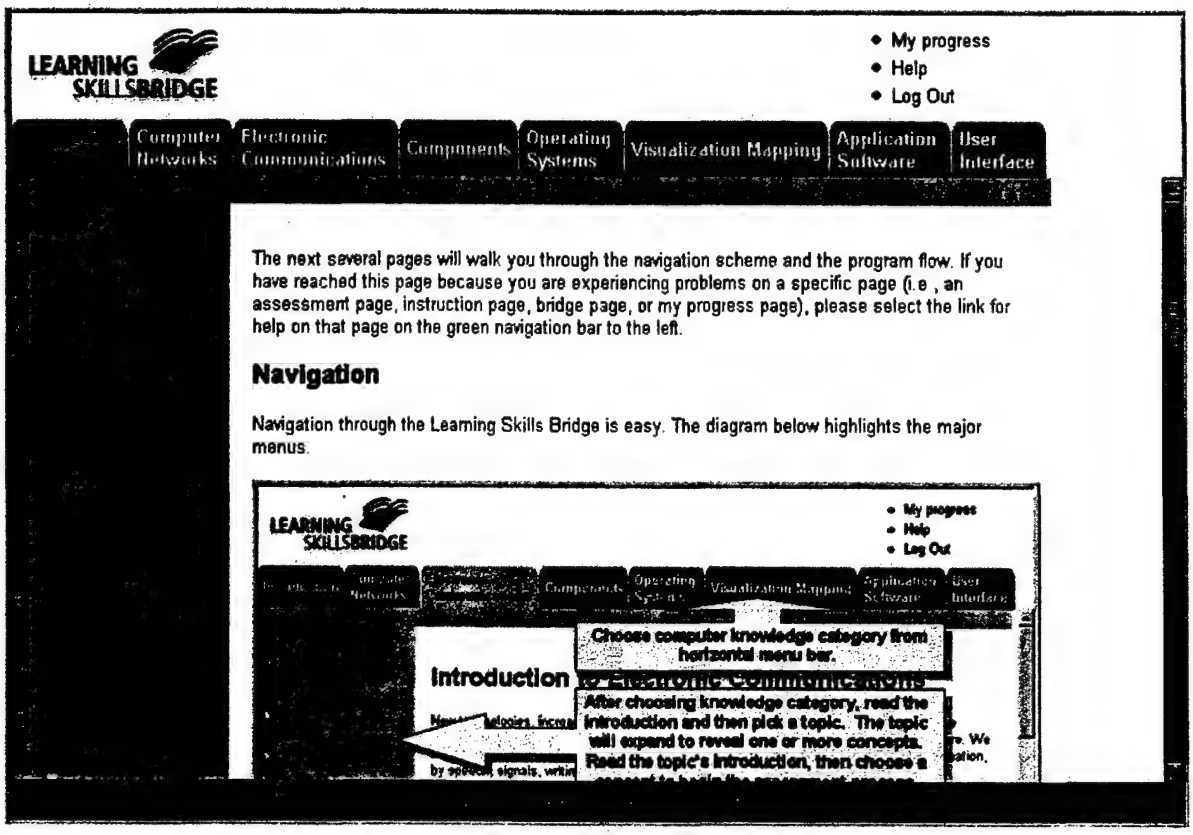

Figure A-5. Screenshot of "Navigation" Page

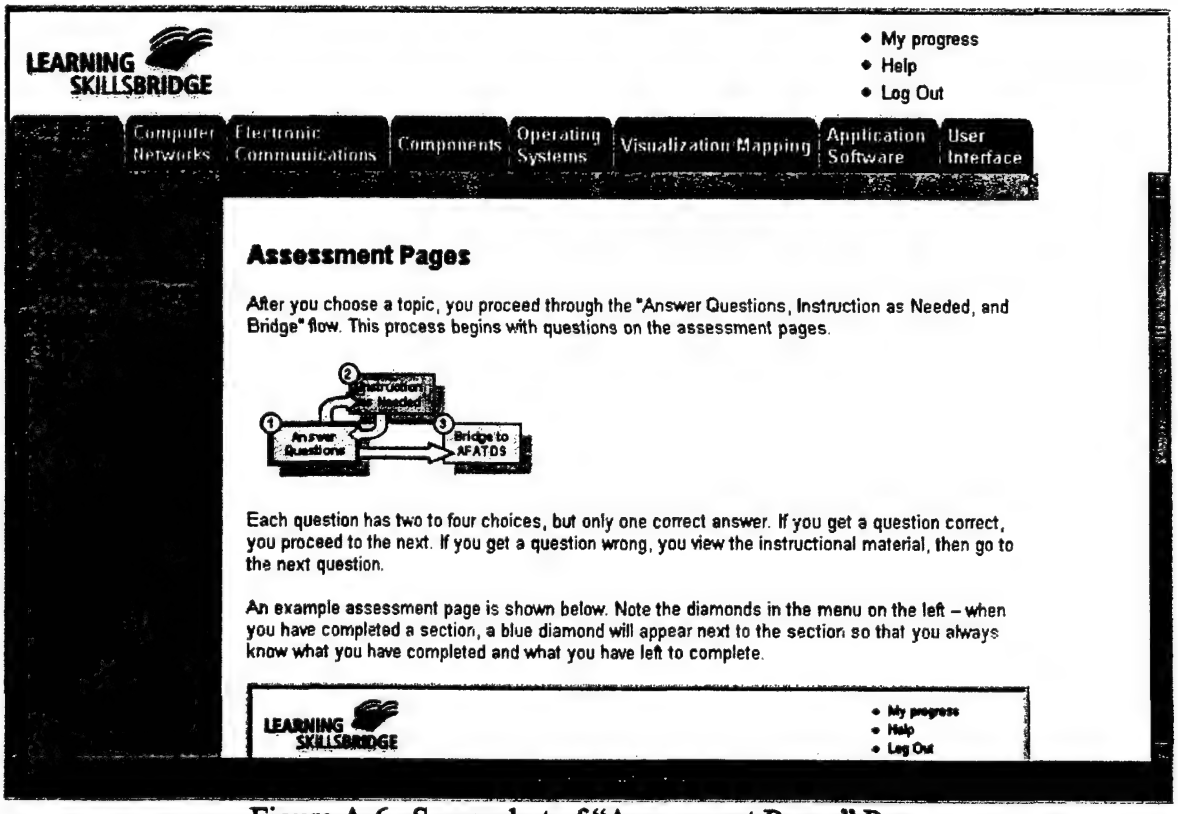

Figure A-6. Screenshot of "Assessment Pages" Page

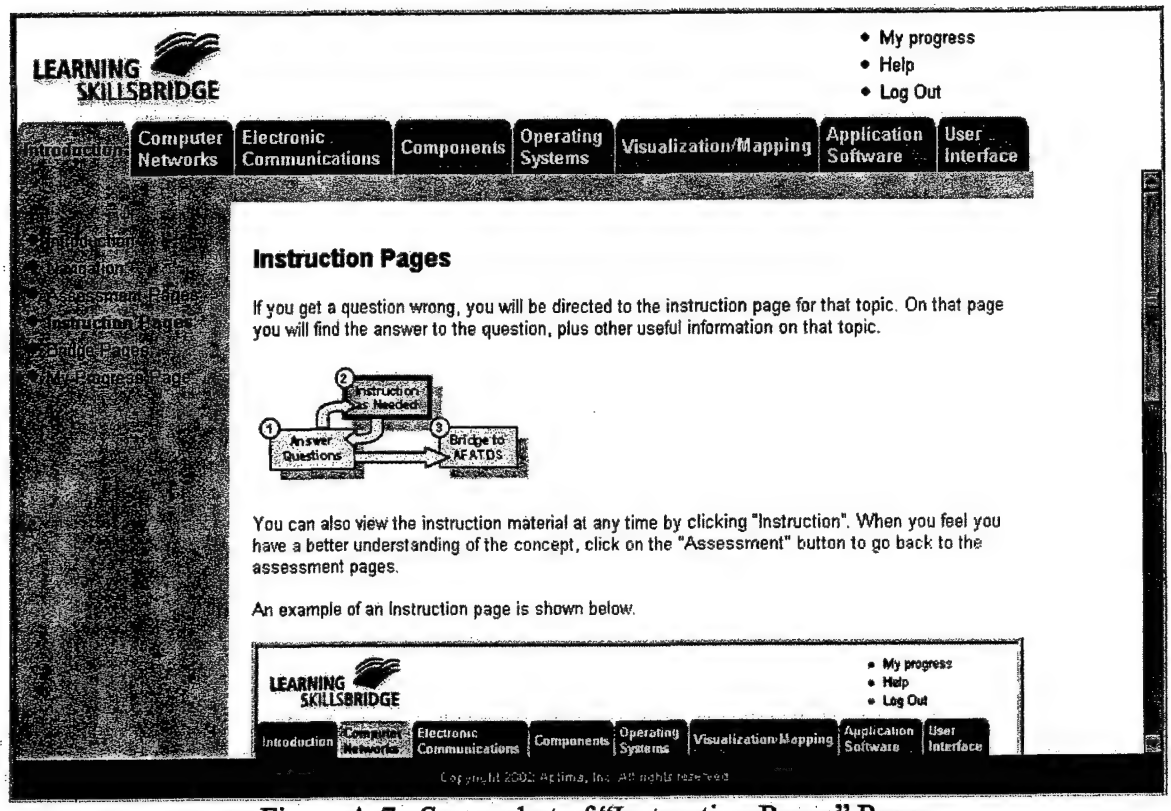

Figure A-7. Screenshot of "Instruction Pages" Page

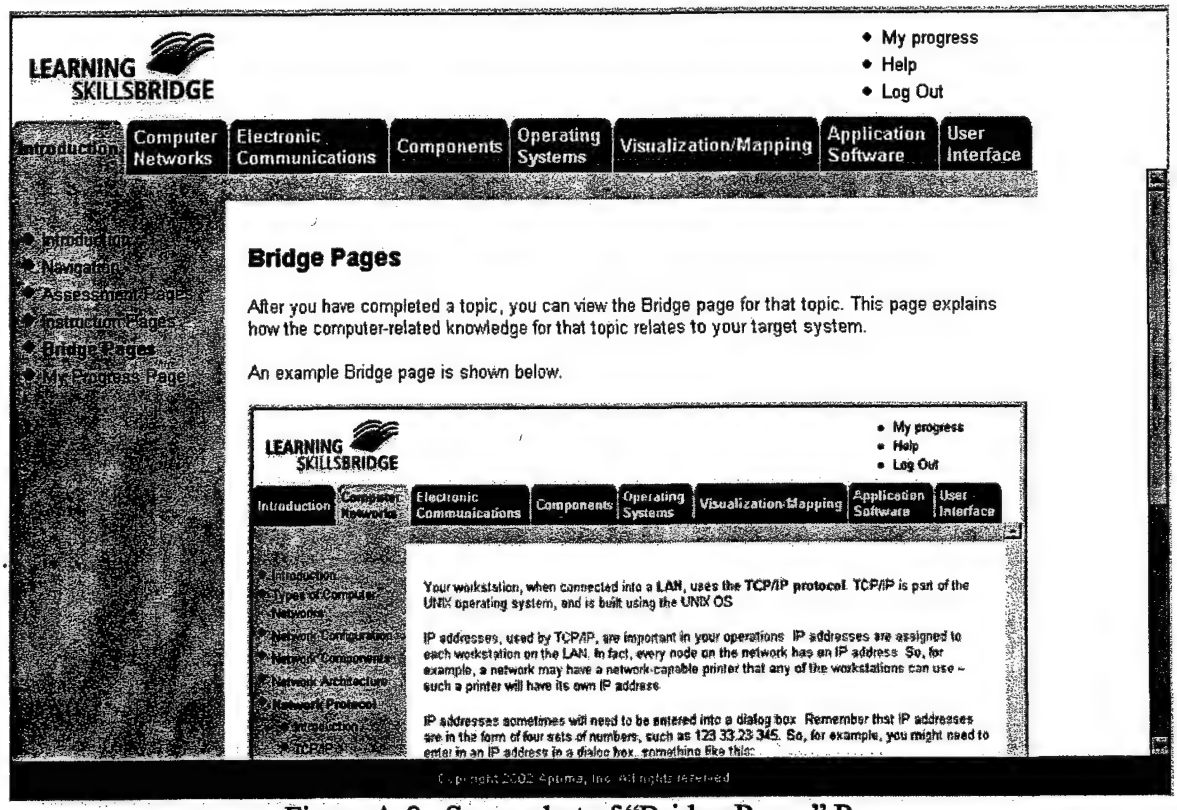

Figure A-8. Screenshot of "Bridge Pages" Page

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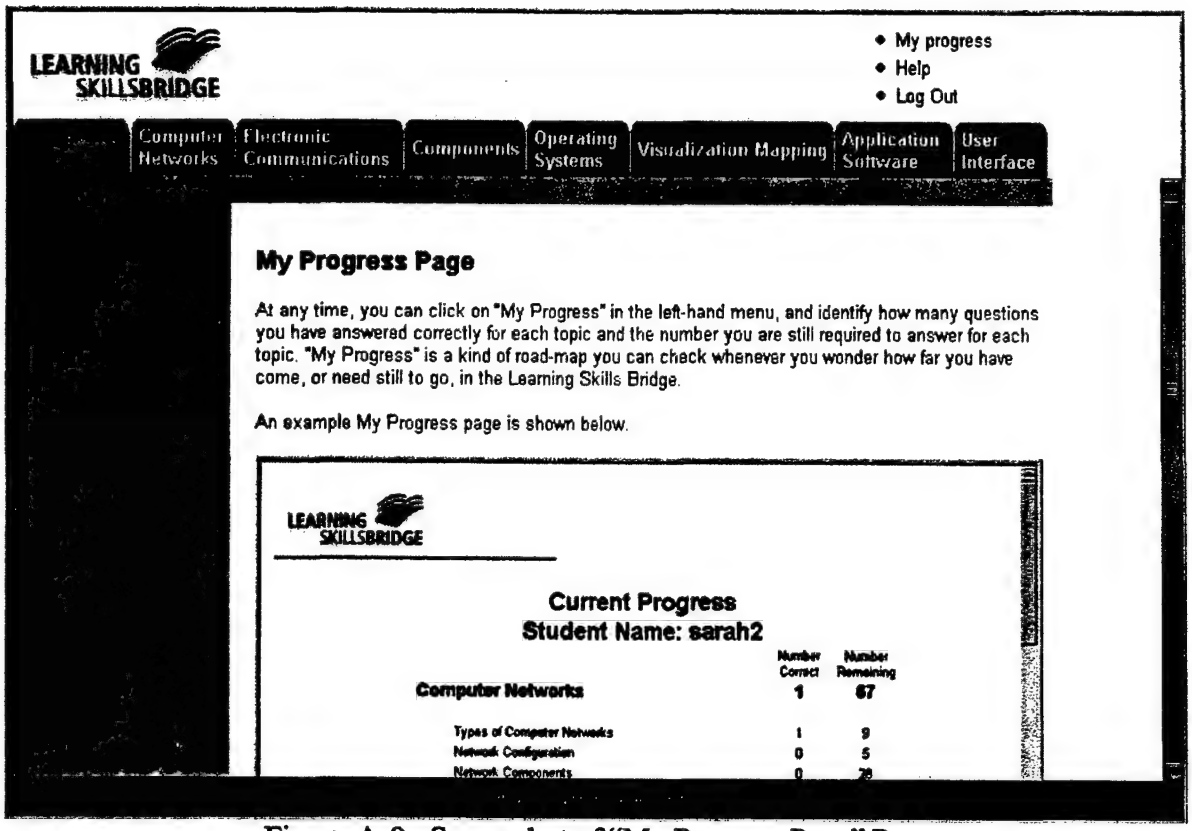

Figure A-9. Screenshot of "My Progress Page" Page

The introduction, as with the rest of the LSB program, is designed to flow from one topic to the next through the use of a "continue" button at the bottom of the screen. For users who prefer to focus on topics in a different order, they may simply click on the appropriate category and topic in any order (see Figure A-10).

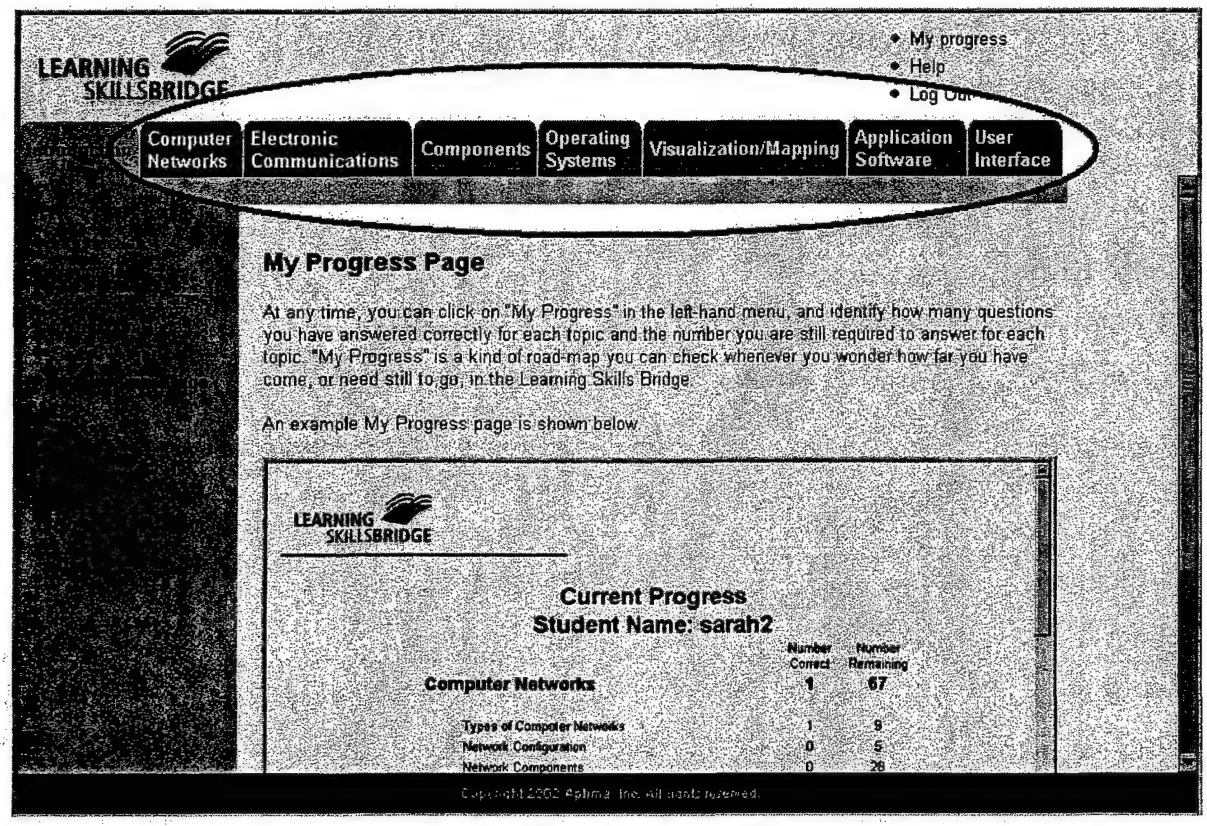

Figure A-10. Screenshot pointing out ways to start a computer skills category

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By clicking on a category, in this case "computer networks," users are taken to an introduction page for the chosen category (see Figure A-11). The introduction sections provide a general overview of the selected category. Within the introduction, key or important terms are bolded and are active (placing cursor over bolded text provides the user with a definition of the term or terms).

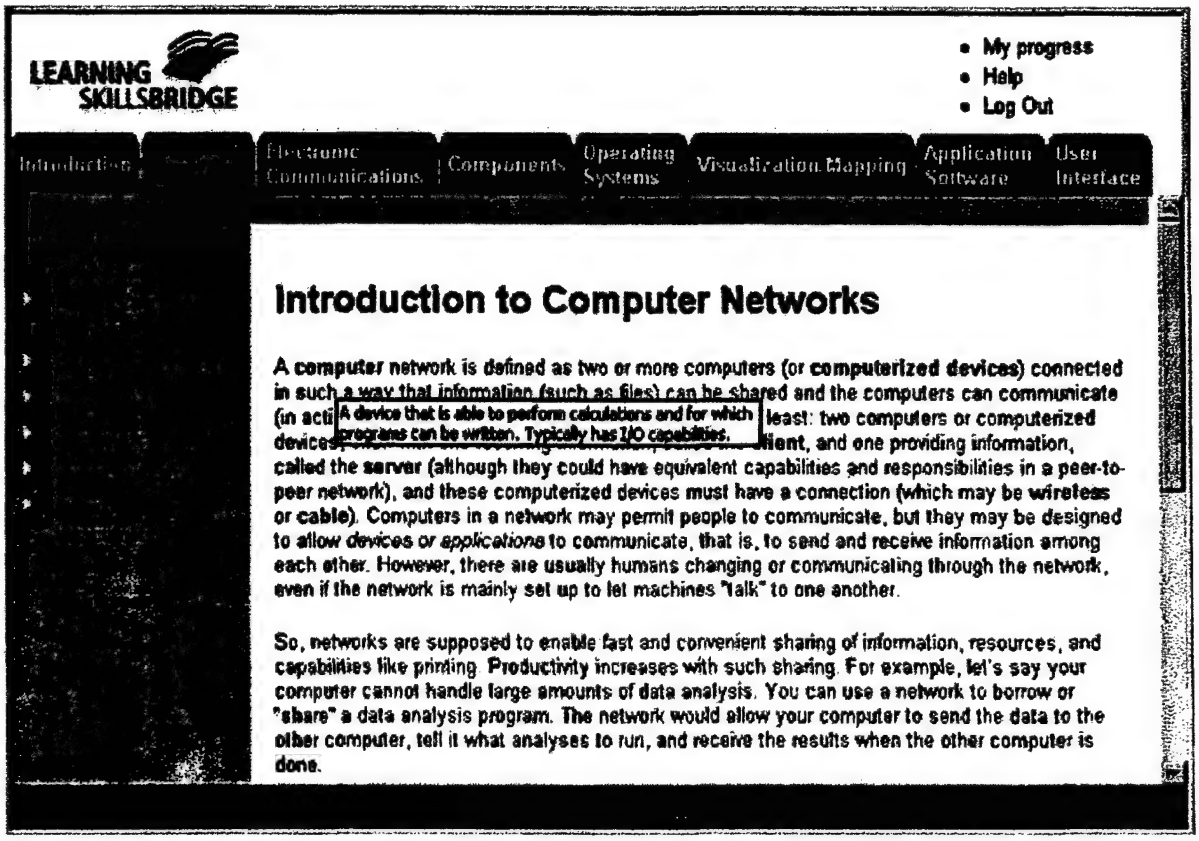

Figure A-11. Screenshot of "Introduction to Computer Networks" (Category) Page

Clicking continue at the bottom of the screen takes users to the introduction page for the first topic within that category (see Figure A-12), in this case "Types of Computer Networks".

The topic introduction pages are organized similar to the category introduction pages (i.e. provide general overview of topic and bolded terms with roll over capability when needed).

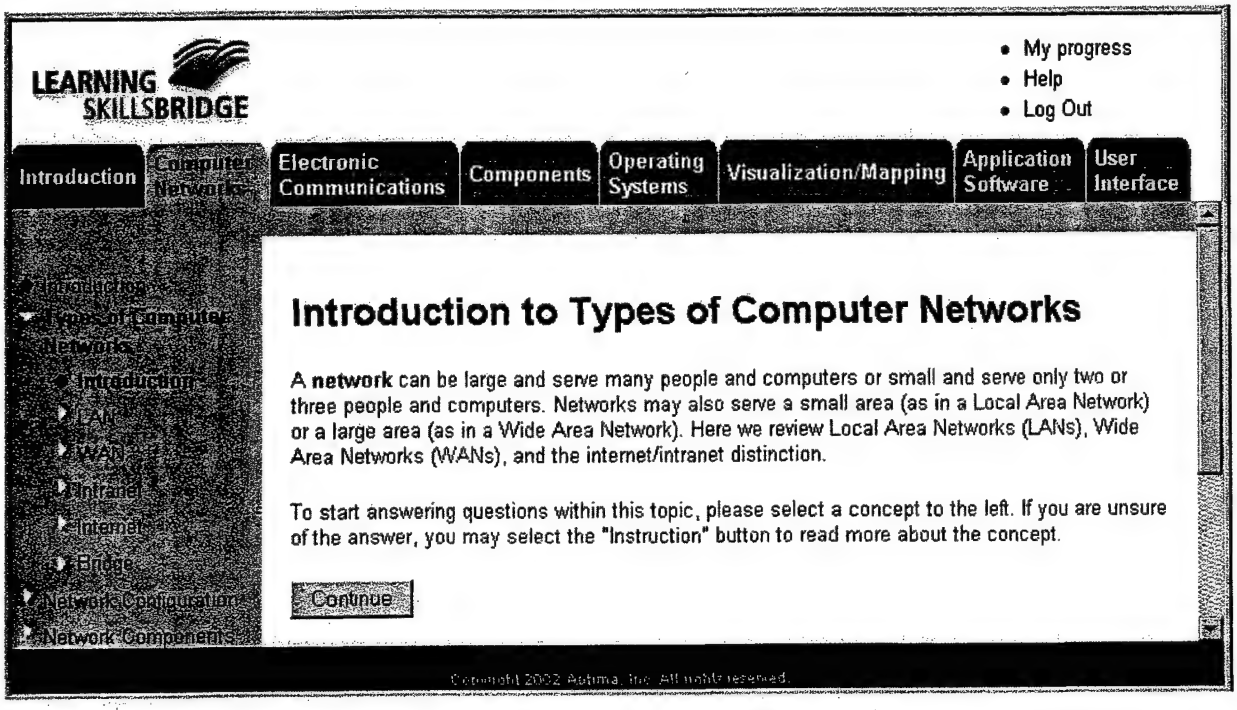

Figure A-12. Screenshot of "Introduction to Types of Computer Networks" (Topic) Page

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By clicking continue at the bottom of the topic introduction page, users are taken to the assessment pages for the particular concepts, in this case "LAN" (see Figures A-13 and A-14 for Assessment Page examples)

The assessment pages contain questions for each of the concepts and appear in a random order. Questions take the format of true/false (Figure A-13) or multiple-choice (with at least 3 response options; Figure A-14).

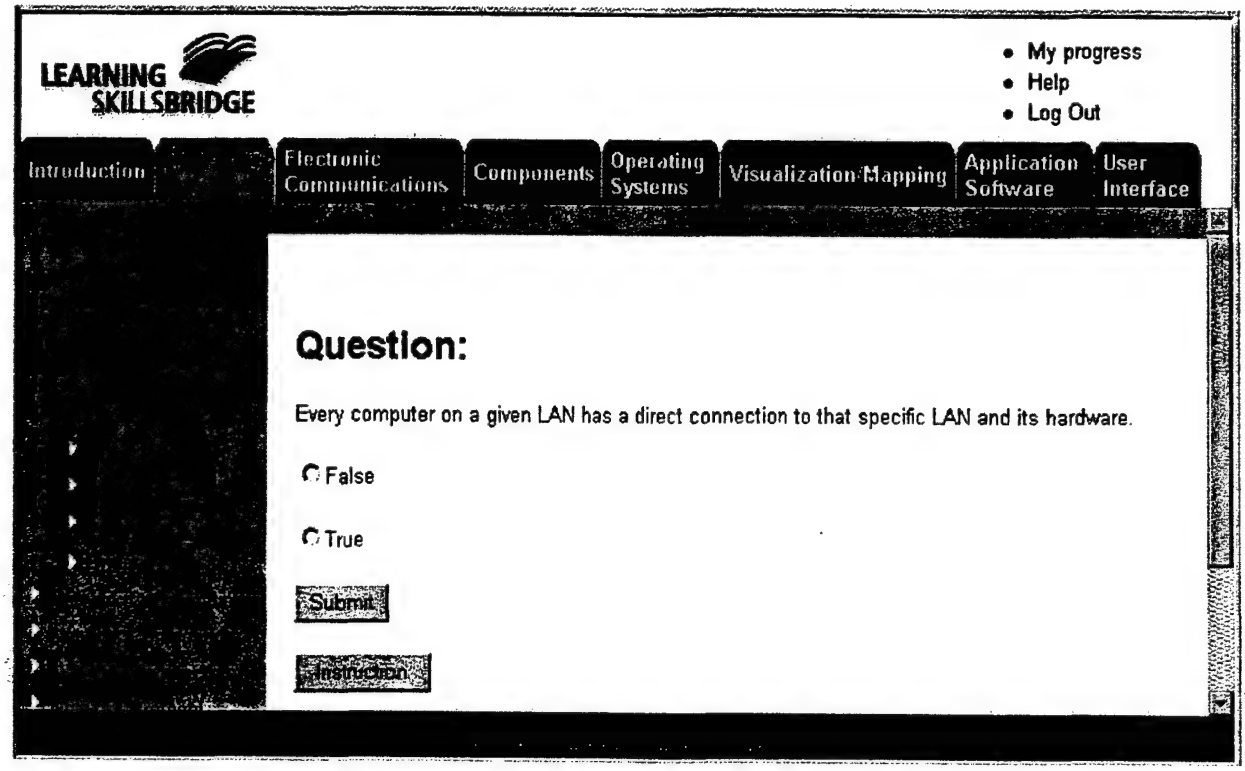

Figure A-13. Screenshot of Assessment Page with a True/False question

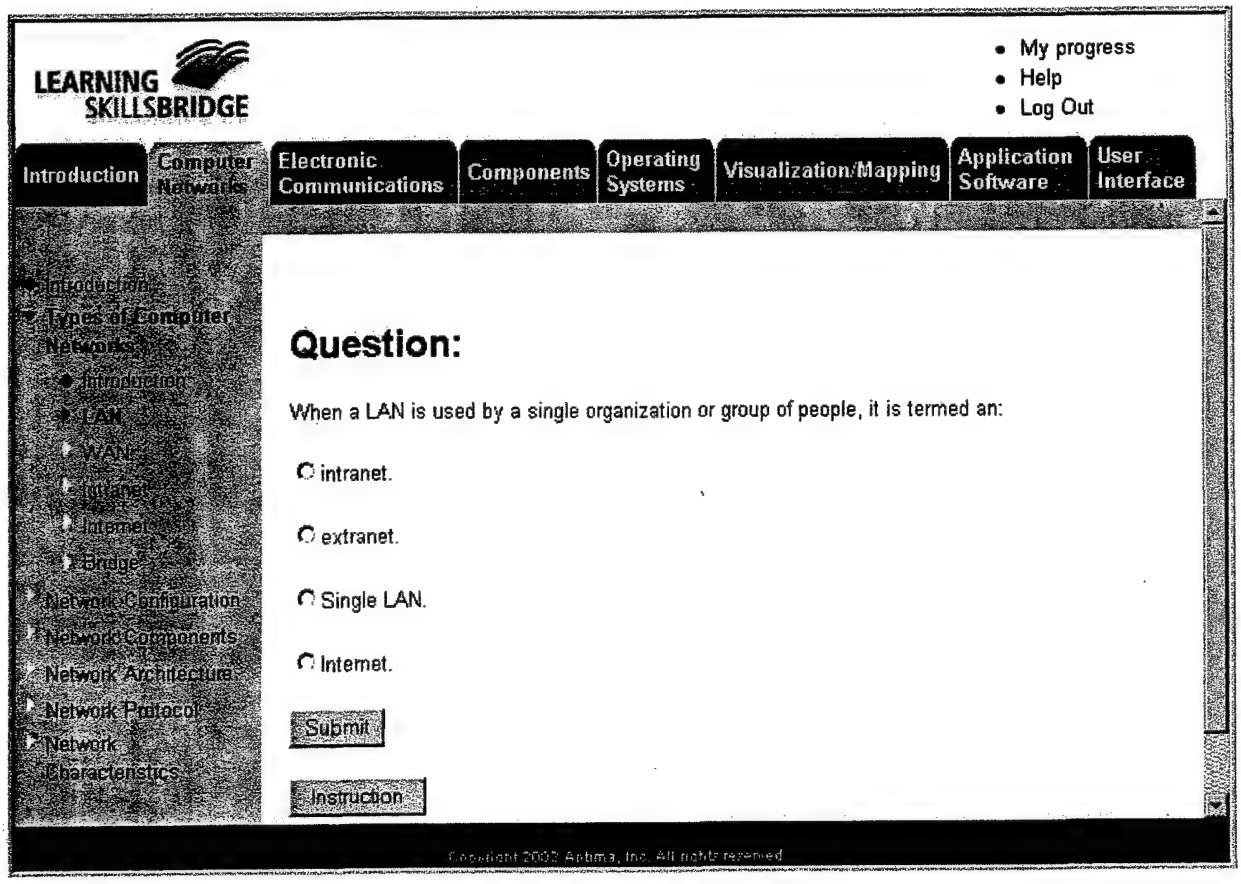

Figure A-14. Screenshot of Assessment Page with Multiple Choice Question

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Users simply click the radio button associated with their choice of answers to the particular question and then click the "submit" button. If the user does not choose an answer, they are taken to a screen indicating that they did not do so (Figure A-15), and by clicking the "continue" button are taken back to the specific question.

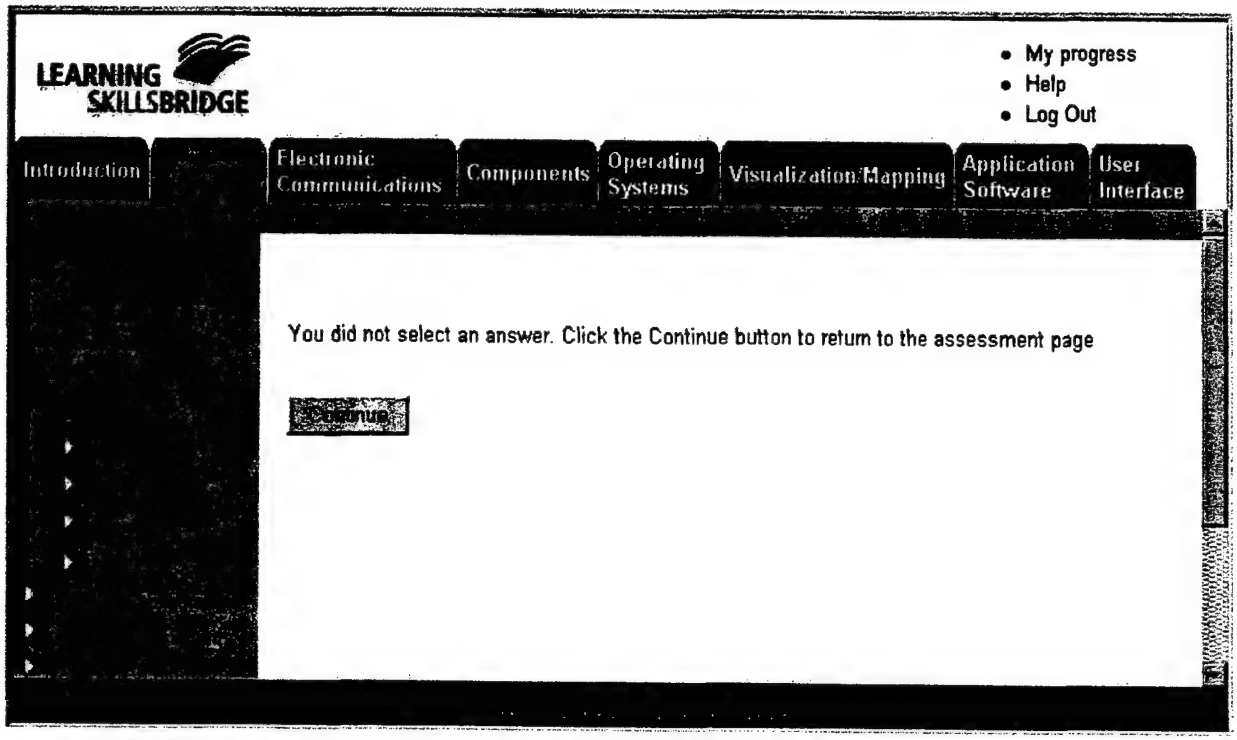

Figure A-15. Screenshot for When a Student Does Not Select an Answer

If their response is correct, they receive confirmation that their answer is correct and are prompted to click continue to the next question or topic (Figure A-16).

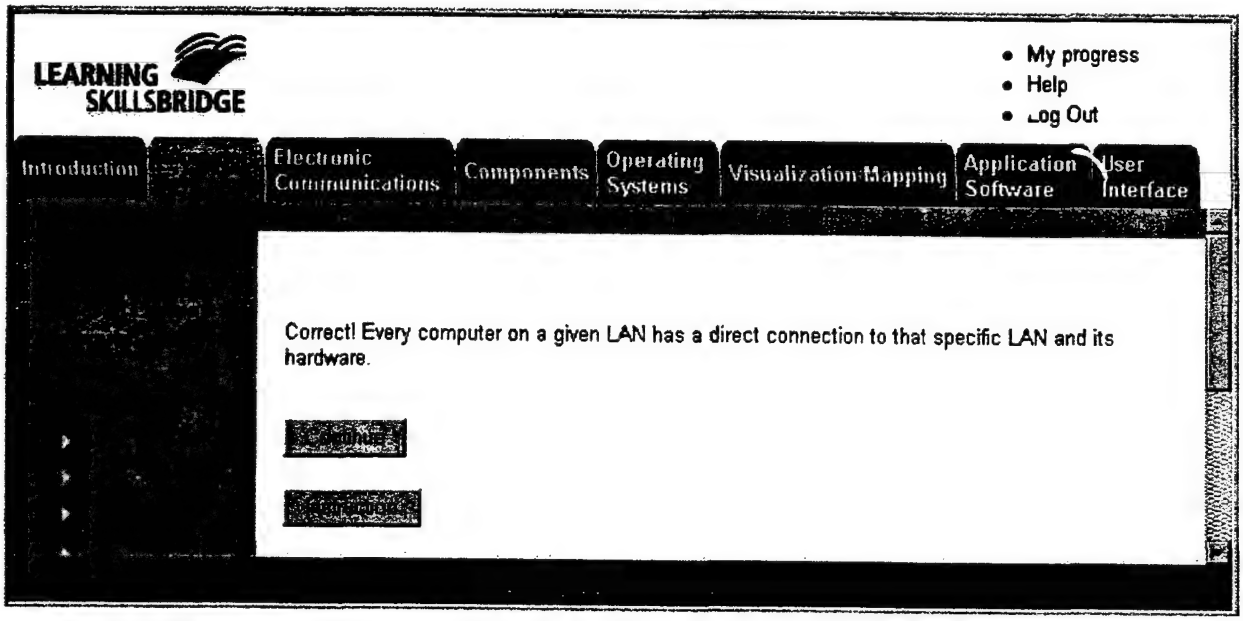

Figure A-16. Screenshot of a "Correct Response" Feedback Page

If the user's response to a question is incorrect, the user receives a message indicating that the answer is incorrect (Figure A-17).

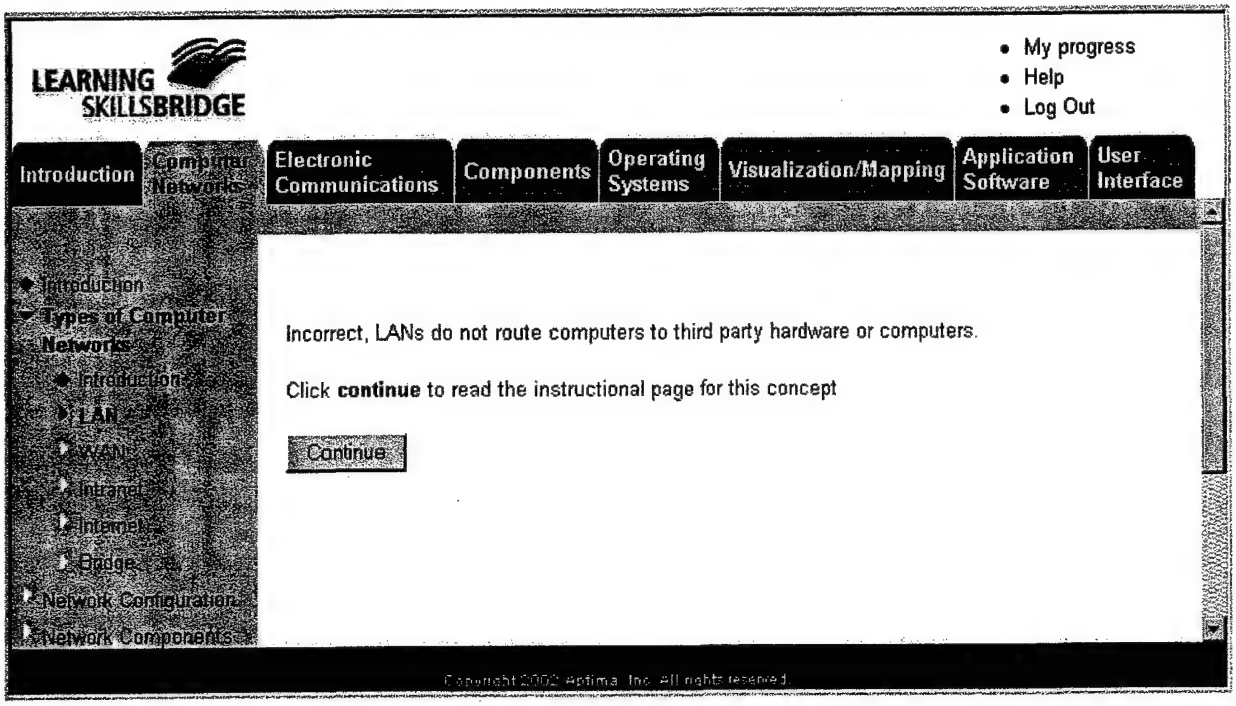

Figure A-17. Screenshot for a "Incorrect Response" Feedback Page

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They are then prompted to continue on to the instruction pages for that topic. The instruction pages (See Figure A-18) provide important information for the current concept, in this case LAN, which may include definitions and information of how this concept relates to other concepts in the topic.

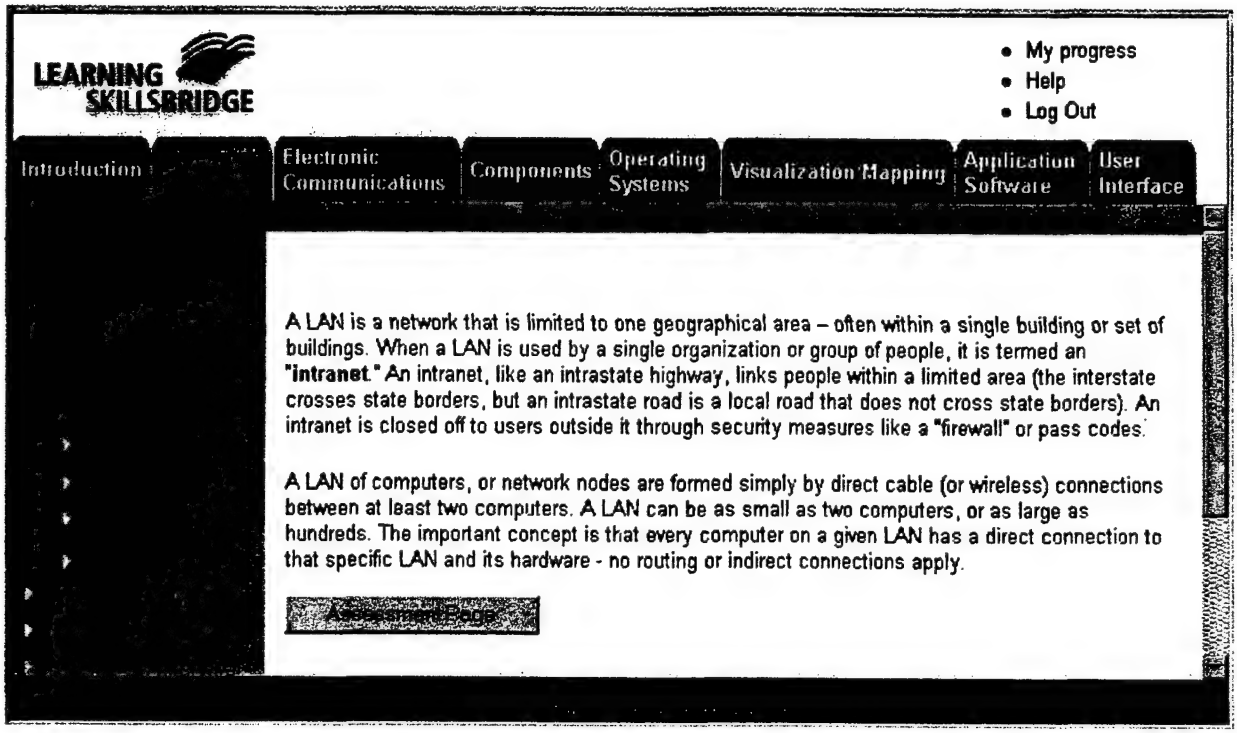

Figure A-18. Screenshot of "LAN Basic Instructions" Page

It is important to note that users may access the instruction page for the concept at anytime during the assessment process by simply clicking the "instruction" button (Figure A-19).

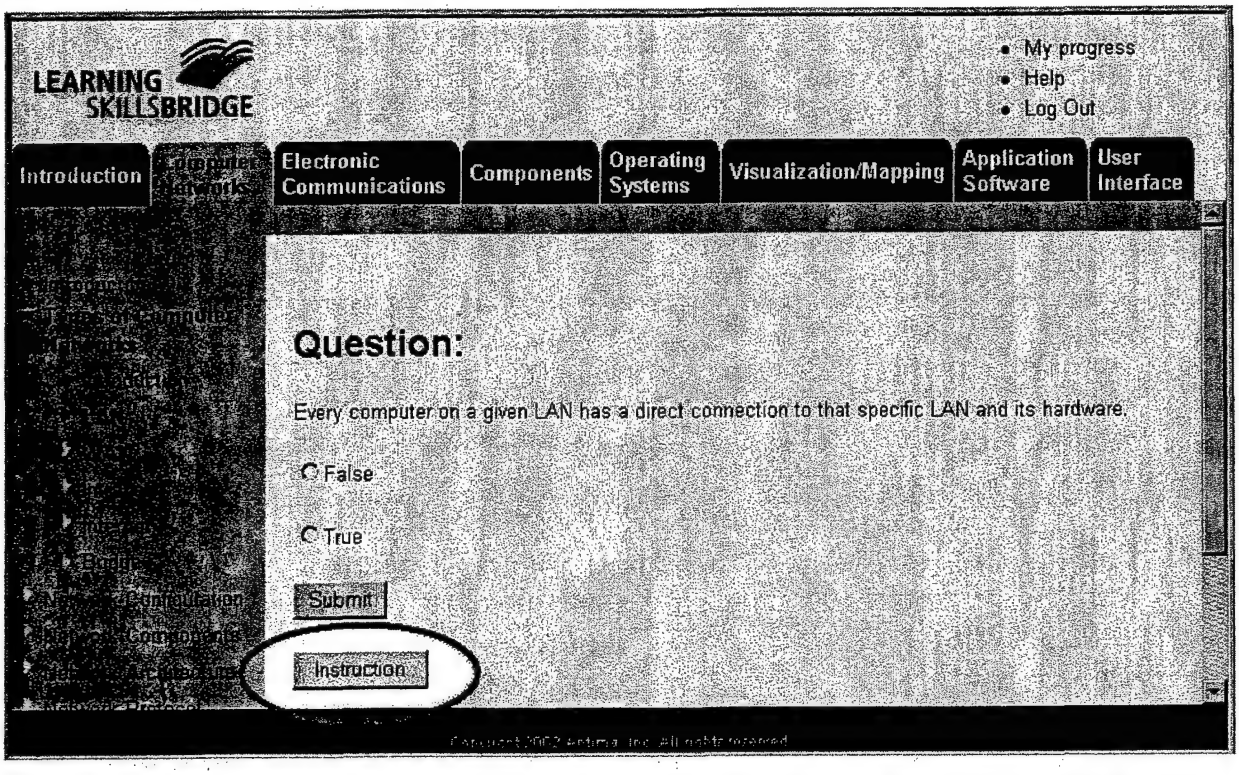

Figure A-19. Screenshot pointing out button to access Instructions from the Assessment Pages

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After answering the predetermined number of question for a concept correctly, the user is congratulated (see Figure A-20) and then taken to the assessment page for the next concept within that topic, in this case "WAN."

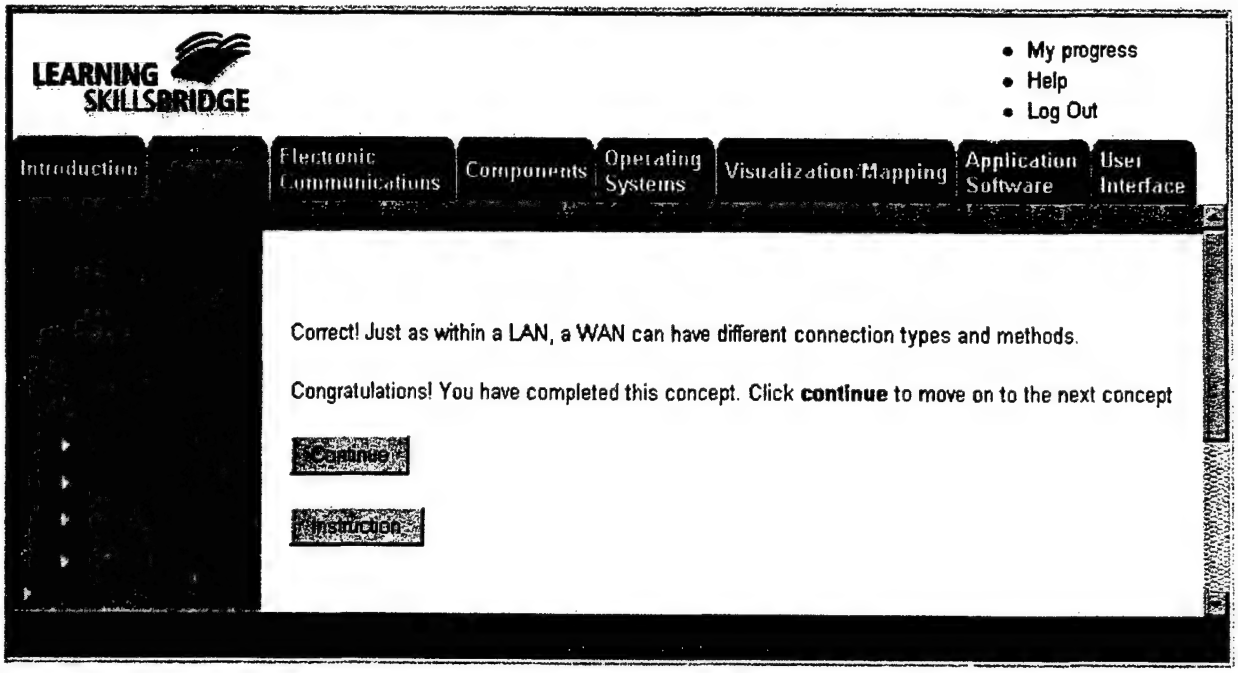

Figure A-20. Screenshot of Page Indicating When a Concept is Finished

Once the predetermined number of questions for all the concepts for a topic have been answered correctly, users are taken to the bridge page for that topic, see Figure A-21 for a sample bridge page. The bridge pages provide an explanation of how the current topic applies to the target computer system, i.e., AFATDS (for export control purposes, Figure 33 does not contain AFATDS-specific information). The bridge pages often include both pictorial representations of how the topics relate as well as important bolded terms with rollover capability.

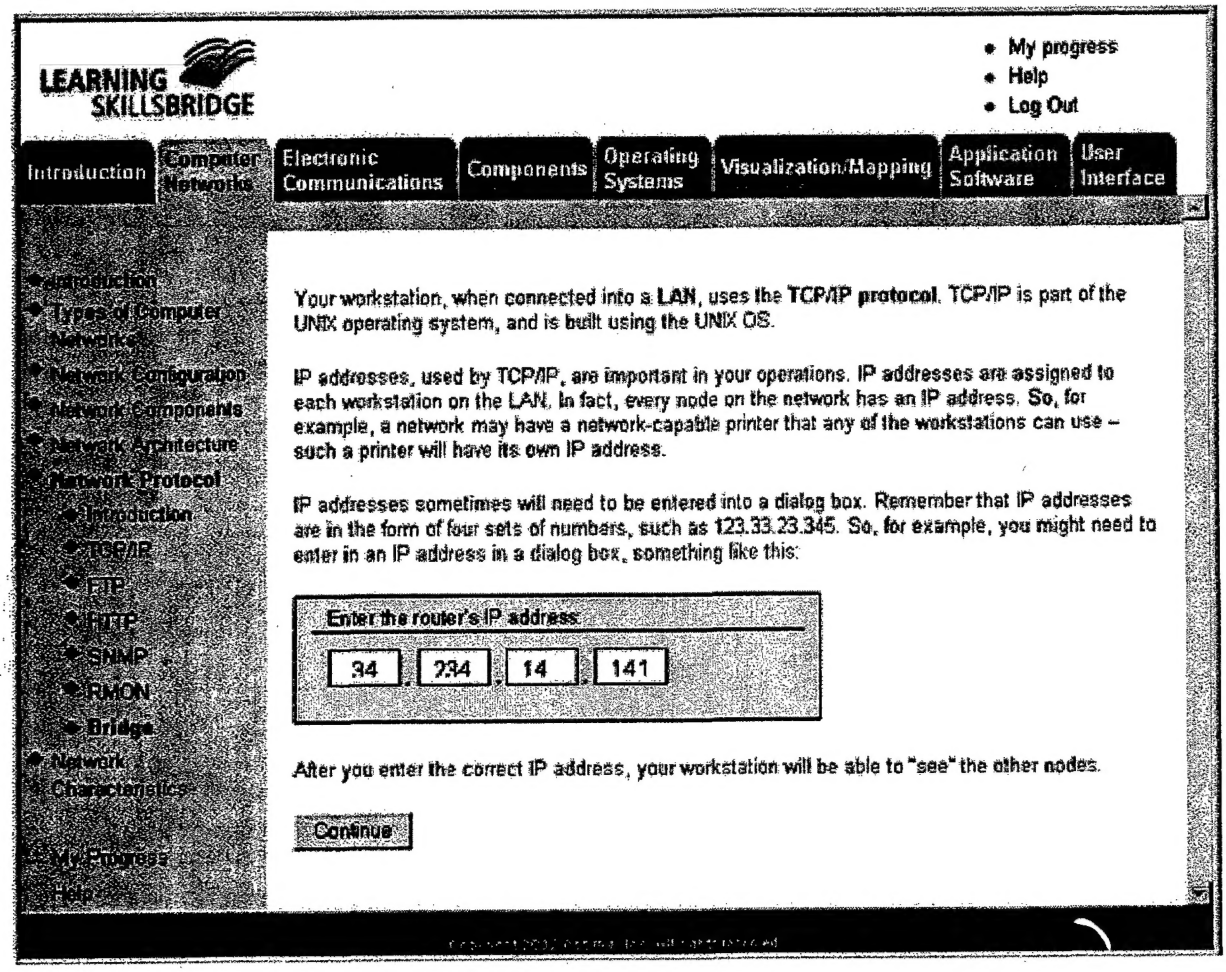

Figure A-21. Screenshot of "Bridge" Page

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This general process continues throughout the program. After finishing all of the topics within a category, the user is taken to a "Category Status" page (see Figure A-22), that provides information regarding the number of correctly answered question required to complete a category.

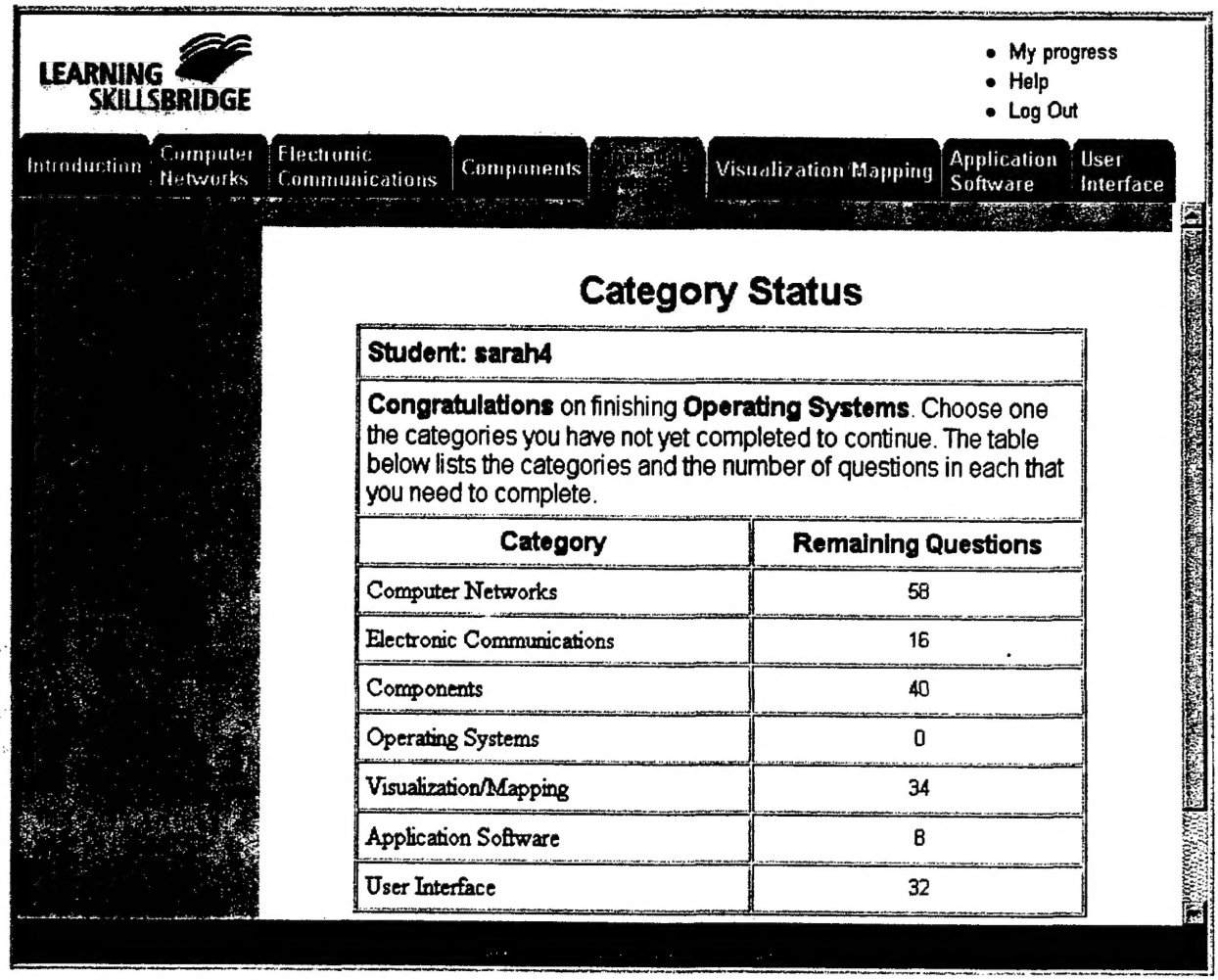

Figure A-22. Screenshot of "Category Status" Page.

It is important to note that users may access their "My Progress" page (Figure A-23) at anytime by clicking the "my progress" links located in the upper right portion of the screen and the bottom of the left vertical navigation bar.

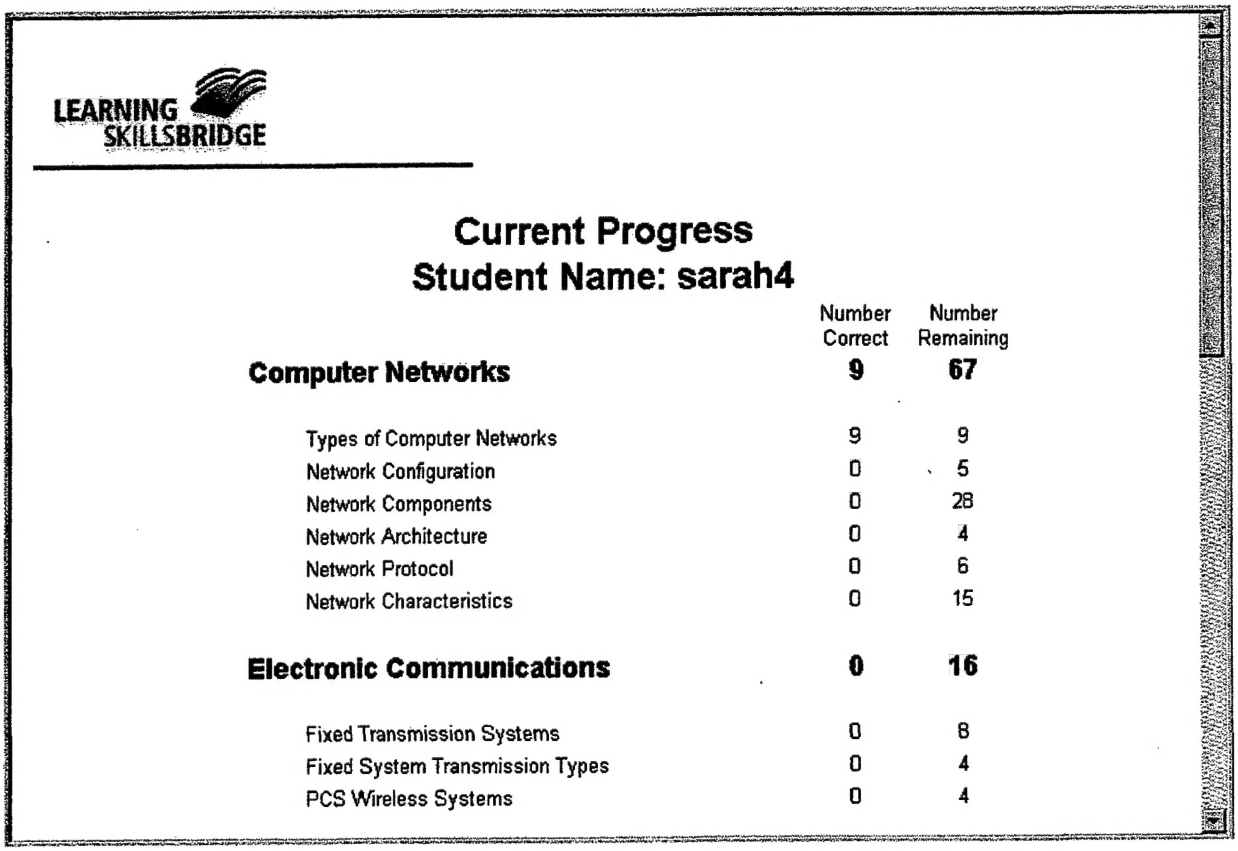

Figure A-23. Screenshot of "My Progress" Page pointing out also how to get there

Another feature included within this program is the "help" option. By clicking either of the two "help" links located just below the "my progress" links, users are taken to the navigation page (See Figure A-5), which provides users with assistance related to navigation of the site including program flow, assessment pages, instruction pages, bridge pages, and my progress page.

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As mentioned earlier, navigation through the program is designed to be non-linear; users are free to complete the program on their on schedule and in the order they desire. Once they complete the program, they are taken to a screen congratulating them and indicating that they have completed the LSB training program (Figure A-24).

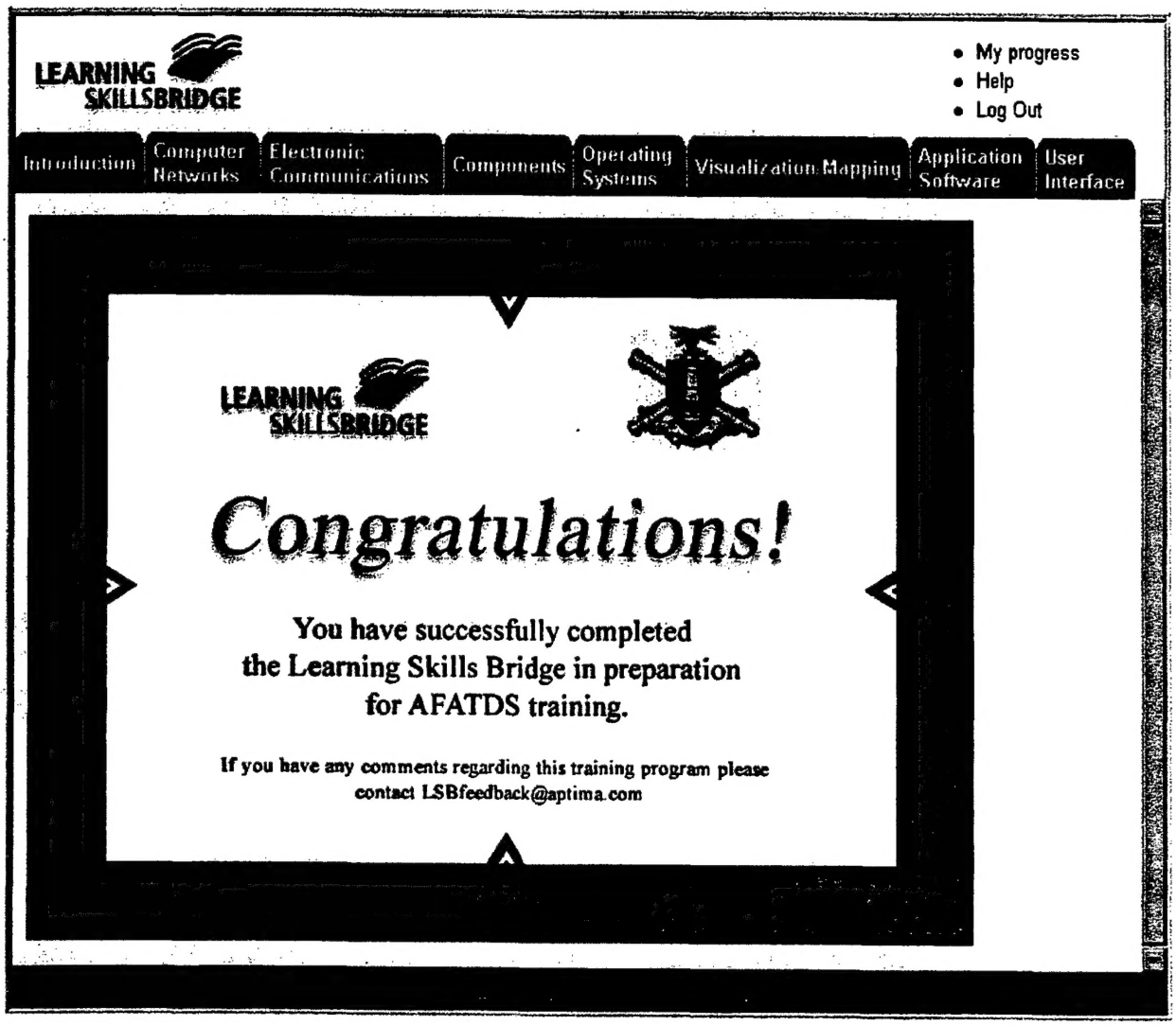

Figure A-24. Screenshot of "Certificate of Completion" Page